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Two groups of hard of hearing children entered educational audiology programs between the ages of 6 to 42 months. Of these, 12 children in a unisensory program (U-) and 16 in a multisensory program (M-) were evaluated for speech and language development after they had reached their fifth birthdays. Children in the experimental U-group were first tested for hearing and fitted with an aid, then were given auditory training at home and in group therapy sessions. At age 3, they were evaluated for placement in an enriched nursery school program, which also trained them primarily through the auditory sense. Guidance and psychological counseling were provided for the parents. Results indicated that the U-group was markedly superior on all measures of speech and language acquisition, although less so on the Templin-Darley articulation test. On all other measures (mean length of responses, mean of five longest responses, number of one-word responses, number of different words, and structural complexity score), results for the U-group appeared to indicate the advisability of unisensory management. Findings suggested that U-management may be of most benefit to children whose residual hearing extends into the high frequencies and whose hearing losses are relatively flat. (JD)

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Project No. 969
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Joseph L. Stewart

December 1965

The research reported herein was performed pursuant to a contract with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

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Colorado Seminary
(University of Denver)

Denver, Colorado

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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PROBLEM

The problem investigated was to determine if a program of educational audiology would aid the speech and language development of the moderately to severely hard of hearing child to the extent that the child, when he enters school, might be integrated into a normal hearing classroom. The hard of hearing and deaf child has in the past presented a major problem to the educator in that special classes in special schools have had to be provided for him. If new methods of aural education are developed, such as that which has been termed "educational audiology," which can substantially improve the speech and language development of these children, more of them might be integrated into the normal hearing classroom at an earlier age.

This study had as its aim the evaluation of a program in educational audiology, (sometimes referred to as the "acoupedic method"), as a method of training the deaf and hard of hearing child through the auditory sense. As such, it differs from the oral method in that the oral method is that approach to educating the deaf that stresses spoken language in preference to manual language and emphasizes lip reading as the primary means of language learning. The method employed in this investigation was developed by Huizing (1959), who states: "This new philosophy is principally based on the education or reeducation of the function of hearing . . . with regard to this method it should be our aim to make even the smallest amount of residual hearing an auxilliary aid for communication." Similar approaches have been developed almost simultaneously in Europe, notably those of Whetnall (1953, 1956) and Bentzen (1962).

Basic to these approaches has been the development, in recent years, of the emphasis on early diagnosis and remedial procedures for the child with limited hearing. As a result, much of the resistance toward fitting the young child with a hearing aid has lessened. In the United States, however, there has not been any significant departure from the oral method philosophy that the hearing impaired child should be trained visually through speech reading. While this philosophy does not dispute the value of auditory training, it is basically multisensory and stresses vision as the primary channel of communication. Gaeth (1960) has described this position in relation to the learning of normal children: ". . . a combined auditory-visual presentation is considered superior to a presentation that is only auditory or visual. However, the effect of bi-sensory presentation is likely to be different when one sense modality is deficient."

The theoretical premises underlying the program upon which this research was based, as previously published by Stewart, Pollack, and Downs (1964), are as follows:

1. The auditory sense is the most suitable perceptual modality by which a child learns speech and language.

Much of the opposition to a uni-sensory approach stressing audition follows from the assumption that, since the child's unaided hearing is deficient, his auditory sense is non-functioning. There are very few children for whom this is true. Huizing (1959) notes that less than 5% of the children in schools for the deaf in the Netherlands appear to be totally deaf and that a half century of attempts to use the residual hearing of the children in these schools has not resulted in "a substantial change in the character of the oral method." Watson (1961) reports that 95% of the pupils in schools for the deaf in England have some residual hearing and that 40% can achieve a considerable degree of speech perception by hearing alone; through auditory training about 70% should show very marked improvement in speech and language development. In the United States, Hudgins (1953) reported improvement by deaf children in speech perception, general educational achievement, and speech intelligibility after having received auditory training and he further noted "it has been possible to stimulate acoustically even the very profoundly deaf children." Freud (1956) wrote that so far as schools for the deaf were concerned, "hearing aids are considered as being useless for profoundly deaf children."

It must be emphasized that the children referred to above fit the criterion of having measurable residual hearing. On the basis of his work with hearing-impaired children in the Netherlands, Huizing (1959) classifies the children into four categories. Children in three of these categories can profit from amplification; those in the fourth category, the totally deaf, cannot. Huizing maintains, however, that the principle of auditory treatment in these cases should not be given up before there is positive evidence that the deafness is total. Even for those who have minimal residual hearing, the unisensory approach maintains that all children with any measurable hearing need amplification if only for the formation of a hearing-controlled voice.

A second function served through use of a hearing aid besides that of providing the child with some auditory stimulation is that of emphasizing the hearing residual rather than the hearing loss. The observation is often made that parents and clinicians tend to deprive the limited hearing child further by speaking to him less once they have found that he is "deaf". In 1880, Mallery (1881), a layman insofar as deaf education is concerned, noted in a discussion of sign language among North American Indians that "congenital deaf mutes at first make the same sounds as hearing children of the same age, and, often being susceptible to vibrations of the air, are not suspected of being deaf. When that affliction is ascertained to exist, all oral utterances from the deaf mute are habitually repressed by the parents."

A related problem leading to an unrealistic evaluation of the child's hearing potential is the practice of making decisions and judgments, including school placement, on the basis of the child's unaided audiogram. The limitations of the audiogram as a descriptive measure of the extent of handicap, particularly when no measure of the child's unaided hearing is available, needs to be stressed more by those counseling parents.

Dale (1962) suggests that a report on a child's deficiency should include a descriptive statement of the percentage of simple speech materials, such as single words, the child heard correctly while using an aid. This is of particular importance where school placement is concerned. It seems evident that the level of the child's language development should be the primary consideration in determining school placement rather than having placement made on the basis of audiometric data alone. Sortini (1959) maintains that school placement should not be made only on the basis of the hearing loss and Fry and Whetnall (1954) state that with "adequate and early auditory training, many deaf children are capable of holding their own in ordinary schools."

While the practice of recommending hearing aids for young children has increased, the age at which the child might begin wearing an aid is still somewhat controversial. The educational audiology approach stresses the fitting of a hearing aid as soon as a bilateral sensorineural hearing loss has been confirmed (preferably before the age of 18 months), since deprivation of stimulation may result in a lack of total development of the hearing residual. Several investigators in the field of audiology emphasize the importance of early amplification. Bangs & Bangs (1952), for example, recommend an aid during the first 18 months of the child's life and Watson (1950) reports severely deaf children being fitted between 11 months and three years. Fry and Whetnall (1954) suggest the use of the hearing aid during the child's first year. Sortini (1959) feels that the aid should be fitted as soon as possible after the diagnosis of hearing loss has been made, and states that the child fitted at pre-school age receives significantly more benefit from amplification than the child fitted at school age.

Recent neurophysiological studies appear to support the view that the interpretation of sensory stimuli is learned and that the restriction, or deprivation, of the use of a given sense causes irreversible perceptual dysfunction. Riesen (1947) found that when a chimpanzee has been raised in total darkness for the first three months of its life it never develops adequate vision. However, chimpanzees raised in the light for the first three months of life and subjected to total darkness for the next six months rapidly regain perfect vision when again exposed to light. The extent to which such results can be generalized to include the ear are hypothetical, but is of interest to note that Rushford and Lowell (1960) report that age is related to the child's acceptance of a hearing aid with the youngest group reported (those fitted at 2.5 years) showing the greatest proportion of acceptance. Such indications in children, reinforced by controlled animal studies, point to the necessity of providing sensory stimulation by the time the critical period of development of the sensory modality is present. No estimates have been made as to the exact time of the critical period of auditory perception, but it is probably before the second year of life.

Insofar as sensory deprivation is concerned, the placement of a hearing aid on a child is by no means the total solution to the problem. Miller (1961) for example, notes that recent investigations "indicate that cutting the amount of energy coming through the sense organs does not produce sensory deprivation. Rather, it is the amount of patterning . . . of information which is significant . . . (so) you may put white noise into the ear at a loud intensity, and the subject can still suffer from sensory deprivation, because he hears noise only, without any informational patterning of sound." Miller suggests that for the organism to function normally, a certain minimal rate of input of information is necessary. It must be recognized that the neural system is limited in the number, form, and sequence of sensory information which can be relayed to higher nerve centers. This limitation necessitates the inhibition of some impulses to provide for the facilitation of others. In the case of amplification to impaired hearing nerves, the input will be distorted to some extent by the inherent distortion of the electronic system. Further distortion may be produced by the damaged nerves themselves. The input to the brain, however, will comprise an informational patterning that will remain consistent with the original sound source.

2. The second major premise of this approach might be stated in these terms: the combined, or multisensory, approach favors the development of the unimpaired modality as the primary communication system at the expense of the impaired modality whereas the unisensory approach develops the impaired modality to its fullest potential. The crucial factor here would seem to be one of "attention"

determining which sets of information are inhibited.

Insofar as the auditory system is concerned, the effects of inhibition and facilitation can perhaps best be illustrated by the distinction between "hearing" and "listening". Galambos (1958) maintains that the brain is organized in one way when listening takes place and another when it does not; this might explain, in part, the adaptation to extraneous noises in the environment and the sudden awareness when a particular sound calls attention to itself. Since hearing is a constant activity, the distinction between hearing and listening is not only desirable but necessary in any consideration of auditory inhibition and facilitation.

Galambos (1958) reports that, in the cat, auditory stimuli of constant strength do not invariably produce the same effects on the brain and that these effects are not limited to those areas of the brain usually considered to have an auditory function. While the cortex plays a crucial role in the function of attention it must be recognized that the auditory system throughout its entire length is under the control of neural mechanisms which allow the passage of some impulses at one time and inhibit such passage at others. This inhibiting action at the level of the cochlea is attributed to the Tract of Rasmussen, a relatively small bundle of fibers originating in or near the superior olivary nuclei and terminating on or near the internal hair cells. Galambos speculates that it is through the action of this bundle of fibers that modulation of incoming messages is controlled through the feedback principle.

One series of experiments which demonstrates the effect of attention on inhibition are those reported by Hernandez-Peon, Scherrer, and Jouvet (1956) in which auditory nerve potential in response to a click were recorded by placing electrodes in the auditory pathway in the brain stem of cats. When competing stimuli were introduced (in this case, two mice in a closed bottle) "the auditory responses in the cochlear nucleus were greatly reduced in comparison with the control responses; they were practically abolished as long as the visual stimuli elicited behavorial evidence of attention. When the mice were removed, the auditory responses returned to the same order of magnitude as the initial controls."

As experiment which partially replicated the work of Hernandez-Peon and associates is reported by Ruben and

Sekulka (1960): "Suitable electrical stimulation of the region of decussation of the olivocohlear bundles, which supply efferent innervation to the Organ of Corti, was found to abolish the response of the auditory cortex to a click, without changing the responses . . . of the 8th nerve in cats. At higher stimulation values the 8th nerve responses were also abolished, and at intermediate stimulus values responses at the medical geniculate and inferior colliculus were suppressed."

One of the most comprehensive critical evaluations of experiments such as those cited above is that of Hernandez-Peon (1961):

> "In preliminary experiments cited by Hernandez-Peon, Scherrer, and Jouvet (1956), Jouvet, Berkowitz and Hernandez-Peon observed a definite reduction of auditory evoked potentials recorded from the dorsal cochlear nucleus during repetitive electrical stimulation of the mesencephalic tegmentum. Later, however, Jouvet and Desmedt (1956) and Desmedt and Mechelse (1958) found inhibition of the cochlear nucleus potentials only from stimulation of a region located laterally within the ascending auditory pathway. In contrast with these negative results, Killam and Killam (1958, 1959) reported that the electrical stimulation of the brain-stem reticular formation inhibited the auditory potentials recorded from the cochlear nucleus, and that the inhibition was intensified by chlorpromazine.

> Under the action of this drug, the threshold of reticular stimulation was lowered, and the duration of the inhibitory effect at the cochlear nucleus has more recently been confirmed by Brust-Carmona, and others (1960). These authors observed that, in cats with electrodes permanently implanted, brief electrical stimulation of the mesencephalic reticular formation elicited diminution of the auditory potentials, together with behavioral alertness not oriented to the acoustic stimulus. It seems as though the transmission of auditory impulses at the level of the cochlear nucleus is under the control of a complex descending system of fibers, and it is likely that a subtle functional organization will be found in the origin as well as in the termination of those descending fibers that end around the cells of the first auditory relay. Aside from differences in experimental techniques, the complexity of such an anatomical arrangement might explain the apparently contradictory results mentioned above."

From the above experimental reports, the inhibition of stimuli seems established, particularly when two sensory systems are involved. Kubzansky and Liederman (1961) support this view in a review of pertinent studies: "The work of the Scheibels, Amassian and others, and Moruzzi and his group in recording with microelectrodes . . . has shown that stimulating the two modalities at once and recording from one or more units will demonstrate that a given unit will respond to one modality and not to another." It is the contention of adherents to the unisensory philosophy that the combined approaches favor the probability of developing the unimpaired modality (vision) at the expense of the deficient modality (audition). Further support for such a view may be obtained from an earlier study by Obersteiner (1879) on attention. He measured the effects of inhibition of competing stimuli by recording the reaction times of his subjects; in one series the competing stimuli presented were auditory and visual. Obersteiner concluded that the addition of "every other sensory impression, of whatever nature . . . . invariably diverts the attention and prolongs the reaction period."

The experiments cited appear to support the claim that maximum use of residual hearing is not to be obtained when the child is taught "visual hearing" via speech reading in conjunction with auditory training and that, if thus inhibited early and prevented from developing fully, hearing could remain a secondary sense. Clinical support for this view can be inferred from the observations of Huizing, who maintains that children who become skilled lipreaders before maximum use of residual hearing is obtained do not fully understand the value of auditory communication since they have adapted to another world of perception and are not able to exert the necessary auditory effort. Whetnall (1953) has stated that the congenitally deaf child who has been taught only to lipread appears incapable of adding the additional ability of listening.

3. A third assumption of the unisensory approach is that in a very young child the development of sound awareness, vocal production, and, eventually, the beginnings of speech can best be achieved in the child's home with his mother providing the stimulation.

For the child of less than two years this is essentially a home training program, under the supervision of the professional staff of the hearing center. In this way the child, through individual amplification, can approximate the language learning experiences of the totally hearing child on several dimensions, such as inflection, pitch usage, stress, and rate, the lack of which are among the more outstanding characteristics of "deaf speech." It must be recognized that no amount of lipreading or kinesthetic training can develop normal skills of vocal usage; these must be heard to be reproduced.

4. The fourth assumption pertains to the child's early formal education. At such time as the clinical staff feel a given child has progressed to the point where more intensive professional care can be profitable, he is enrolled in a small nursery school which is structured along the lines of a "normal" nursery, rather than "special education" program. Stone, Fiedler, and Fine (1961) evaluated the effectiveness of "nursery school procedures modeled on the best practices with hearing children, with speech and language teaching in the context of natural play" by comparing the results obtained with those from a control group taught by more traditional means. On all measures of comparison (speech production and perception, academic progress, and personality development), the experimental group was found to be superior, even though its members had one year less schooling than those in the control group.

Bentzen (1962) reports that in his hearing center in Denmark children with auditory handicaps are enrolled in "normal" pre-schools as a matter of course: "I cannot emphasize enough the need for placing these children with teachers who are trained to teach normal children in a normal school situation. It is too often the case that the teacher of handicapped children views the handicap first and the person second, instead of the other way around."

Throughout the program described in this report, lipreading cues available to the child are kept minimal. This does not mean that the child has no opportunity to see the speaker's face; it does mean that no formal lipreading instruction is employed and the child is expected to develop his auditory capacity in preference to his visual skills in developing speech and language.

Very little research concerning the effectiveness of auditory training upon speech and language development has been published. Huizing (1959) maintains that early amplification does aid in language development and presents learning curves showing the vocabulary growth of a child trained in this method compared to a child trained in the oral method, but no detailed analysis of the development, progress, and structure of the lauguage is made.

Sortini (1959) maintains that early amplification results in better speech and language development, but limits his evaluations of language to the percentage of vowels and consonants spoken correctly at five years of age compared to the percentages for normal hearing children. Hardy, Pauls, and Haskins (1958) studied the language of children with impaired hearing but these children were in the age range from six to fifteen years and were beyond the early formative stages in language development. The effectiveness of amplification was not considered.

An omission in the above reports is an analysis of the composition of the hard of hearing or deaf child's speech, the relationships among amount of loss and speech and language proficiency, the similarities and differences between the process of language development in the hearing handicapped and the normal child, and what changes in the hearing impaired child's speech and language learning are brought about through amplification. There has not been information available dealing with a comparison of the language skills of the hard-of-hearing child trained in the oral method and those trained through educational audiology.

The theoretical bases underlying this approach cannot be considered to be "new" in the usual sense. The concept stimulating a defective ear by an acoustic means is an ancient one. Goldstein (1939) reports that, in the first century, Archigenes advocated the use of a hearing trumpet to intensify the sound for persons with defective hearing. Such instruments, however, do not have the capability of making sounds sufficiently loud for many persons with a hearing loss. As the result, substitutes for audition were developed, notably the so-called oral and manual methods of instructions.

In 1802 a Paris otologist, Itard, noted that by intense stimulation of the ear increased hearing perception could be obtained. This idea was further developed by Urbantschitsch in 1835.

Following these earlier innovators, Goldstein himself developed in this century what he called "the acoustic method." This term was used to distinguish it from the "oral method," "manual method," and "combined method." Goldstein defined the acoustic method as: "Stimulation or education of the hearing mechanism and associated sense organs by sound vibration as applied either by voice or any sonorous instrument." It was Goldstein's contention that every pupil with a hearing loss should receive daily systematic training of the auditory type, regardless of the extent of his hearing loss, his age, or his scholastic status.

Goldstein's method pre-dated the development of the wearable electronic hearing aid. As a result, his beginnings were never adequately followed up and the traditional method of audition supplementing vision continued to gain in favor.

While auditory training has had a very long history, until recently it has generally been used as a supplement for other communication avenues. In practice, the visual system (whether lipreading or the language of signs was utilized) has been the main channel of communication for children with a hearing loss. Basic to the concept explored in this research is the assumption that if the impaired modality is to function adequately it must be trained intensely and systematically. This approach was first developed in the United States in about 1948 at Columbia-Presbyterian Hospital in New York City, when a visiting Dutch physicist, Professor Henk Huizing, observed a class of pre-school deaf children being instructed by Mrs. Doreen Pollack. Dr. Huizing noticed that Mrs. Pollack's approach stressed limiting the number of visual cues available to enforce the development of audition as the child's primary receptive sense. Upon his return to the Netherlands, Huizing developed the first program in audiology in Europe at Groningen University. Almost simultaneously, at least two other programs in Europe were also being developed. One of these was in London at the Royal Throat, Nose, and Ear Hospital under the direction of Miss Edith Whetnall. The other was being developed by Ole Bentzen, M.D., at the State Hearing Center in Aarhus, Denmark.

The program at the University of Denver was initiated by Mrs. Pollack in 1952. The theoretical concepts which this approach is based upon has been summarized by Pollack (1964) and may be described as follows:

First, all emphasis is placed for early training stressing audition. This, basically, is a uni-sensory approach. Two factors appear to be primary importance here, the first being attention to the stimulus. Recent neurophysiological research related to this point has been summarized above. The second factor is that of learning. In common with other sensory functions, listening must be learned. For the child with an auditory handicap, the critical period for such learning may be bypassed if early detection of the hearing loss has not been accomplised.

The second principle upon which this approach is based is the avoidance of lipreading and other competition of sensory stimuli. We ask the child to watch mouth movements simultaneously with listening, whereby the auditory stimulation is placed at a disadvantage, and we expect the child to produce the sounds he sees without ever having heard them. This is done without recognition of the fact that the eyes cannot detect such basic factors as vocal rhythm, loudness, pitch changes, etc. Listening, on the other hand, provides these cues by which the child learns to monitor his vocal feedback and as a result can approximate more normal-sounding speech.

The third principle is that of using normal speech patterns. If the child has been tested and has been fitted with a hearing aid at an early enough age, he can be taught to interpret correctly those signals coming through his communication channel even if it is of minimal capacity, providing those signals are heard consistently. Even though the child may not hear the sound exactly as a normal hearing person does, through feedback and normal regulation he is still able to produce it providing he can hear it. This does not mean a complete avoidance of lipreading, but a postponement of learning the skill until after the auditory sense has been developed to its fullest extent.

This program, then, stresses first of all the early detection and confirmation of the hearing loss followed by early remedial procedures. In those cases in which medical treatment is not warranted, remedial procedures primarily involve the selection and fitting of a hearing aid. As a general rule, the earlier the child is detected and the earlier his remedial program is begun, the better his speech and language development will be. One of the first tasks with a child recently fitted with a hearing aid is to develop his listening function. This involves, first, training in sound awareness and the discrimination of loud as well as quiet sounds. This is followed by focusing the child's attention on sounds and increasing the range and variety of sounds presented to him for his identification. The third step involves teaching the child to respond to sounds appropriately and how to localize sound. These steps precede the actual development of speech by the child. The next step, discriminating among sounds, leads to the process by which the totally hearing child learns speech. The final step in the development of listening skill is that of developing the auditory feedback mechanism, whereby the child not only has learned to attend, learned to listen, and learned to discriminate between sounds but is further capable of producing the sounds and governing their production by means of his own hearing mechanism. It is to be borne in mind the length of time the totally hearing child needs to develop these skills and allow as much time, if not more, to the child with the hearing loss. As a result, for a child with a hearing loss of any degree of severity, even elementary and simple speech sounds are not expected before the child has worn the aid and received training for a period of at least two years.

Assuming the child has been detected early enough, it is of course essential that the development of a listening function be carried out at home as well as in the hearing clinic. For this reason, the acoupedic approach is often thought of as being essentially a home training program. In the early stages, the parent attends therapy sessions with the child and is instructed by the clinician on how to supplement the instruction in the home. At such time as the child has progressed to governing of his vocal output, he may be placed in a group of children his own age for small group thereapy sessions which stimulate verbal interchange among the children as well as between the child and his clinician.

PROCEDURE

Objectives

The specific questions to be investigated in this research were:

1. What is the effect of a program of educational audiology on the acoustically handicapped child's speech and language learning and how does this development compare with that of the normal hearing child?
2. Can the preschool acoustically impaired child develop, through such a program, the speech and language skills necessary for his effective performance in a normal hearing classroom?
3. Are there differences in the speech and language abilities of preschool hearing impaired children trained in this manner and those trained in the oral method and, if so, in what direction do these differences lie?

It was theorized that the child with the moderate to severe hearing loss might develop more effective oral communication skills if his therapy was one which limited the sense modalities being stimulated to the sense of hearing. The child who first learns to use his residual hearing, through amplification, as his primary mode of communication is felt, by the investigators, to develop more adequate language than the child who receives auditory training as a supplement to lip reading.

The procedure outlined was designed to obtain data on three levels of language development: pre-linguistic, early linguistic, and intermediate linguistic. The pre-linguistic level was defined as consisting of those utterances of the child which develop prior to language and are termed "babbling" or "vocal play." The early linguistic level describes the speech of the child when early speech development may be considered to begin. The intermediate level describes that point in time when sentences are formed easily and language may be said to be generally meaningful. Early in the study it became apparent that no meaningful data from the pre-linguistic level would be obtained. This was due, in large part, to the fact that once the children had been found to have a hearing loss of sufficient magnitude, they had already ceased any vocalization of the type desired.

As a result, the linguistic data analyzed were obtained after hearing aids had been selected and vocalization had been stimulated.

The selection of the language variables for study, as outlined below, was made on the basis of previous language studies and the apparent reliability of the methods used to analyze these variables.

Selection of Subjects

Three groups of children were studied during the course of this research. The first of these consisted of children referred to the University of Denver Hearing Center and, each child was selected on the basis of the following criteria:

> The child must have been between six months and forty-two months of age and have a verified bilateral hearing loss existing before the age of one year, or prior to the development of language. Verification was determined by repeated audiometry, coupled with inferential data such as a history of hearing traumatizing

disease, lack of speech development, medical reports, etc. The loss had to be between forty and ninety decibels in the better ear in the frequencies of 500, 1000, and 2000 cycles per second. No child was selected whose hearing loss was other than sensorineural of the extent described above. In some cases, the loss was also found to have a conductive component, but the sensorineural component met the above criteria. Following these criteria, the sample included children who were not only hard of hearing but also some who were, technically, "deaf." No child was selected for whom the sense of hearing could be said to be completely non-functioning and no child with multiple handicaps was selected.

The sample consisted of 33 children who fit the criteria described above. Of this total, twelve were available for intensive study from the time the hearing loss was first suspected until the child reached his fifth birthday. Data on the remainder are presented in the section on Discussion with the notation that these data are, by necessity, incomplete.

The second group for study were provided through the cooperation of the Cleveland Hearing and Speech Center. At the outset of the investigation, it was hoped to establish a control group of hard of hearing children trained by traditional means in the Denver area. Unfortunately, an insufficient number of children were available who had not been "contaminated" by having been, at one time or another, enrolled in the University of Denver program. As a result, the traditionally trained group of 16 subjects was selected on the basis of the following criteria:

> The child must have been between six months and forty-two months of age at the time he was first enrolled in the Cleveland Hearing and Speech Center

program and have a verified bilateral hearing loss existing before the age of one year, or prior to the development of language. Verification of the loss was determined through extensive audiometry, coupled with inferential data such as mentioned above. The loss must have been between forty and ninety decibels in the better ear of the frequencies of 500, 1000, 2000 cycles per second with no child selected whose hearing loss was not sensorineural to that extent. Data on these children were collected by staff members of the Cleveland Hearing and Speech Center at the time the child was approximately five years of age. In many cases, it was necessary to delay the age limit with the result that a number of children are presented who had reached the sixth birthday.

The remedial program for the children in Cleveland is very similar to that for the children in Denver with one major exception: The therapeutic approach utilized in Cleveland is multi-sensory, being auditory training coupled with speech reading. In other respects, such as age at which the child's loss was detected, age at which remedial procedures were undertaken, and age at which the child was fit with amplification were in all cases at least as young as the Denver group and in most cases much earlier. The crucial variable, that of multi-sensory versus uni-sensory management, was the major one distinguishing these two groups and in this regard the Cleveland group is felt to be a superior comparative group than would have been available locally.

The subjects selected to provide data on language acquisition by the totally hearing child were regularly enrolled kindergarten children in the public school system at Modesto, California.[1]

No subject by subject matching between members of this group and the hearing impaired experimental groups

[1] These data were collected by Dr. Max Norton (1962) as part of his doctoral dissertation completed at the University of Denver.

was attempted. The selection of the normal subjects was not restricted on the basis of national origin or parental occupation.

The subjects used met the following criteria:

1. Intelligence quotient as measured on the Ammons Full Range Picture Vocabulary Scale, with a score of 73 or above considered to be sufficient to place the child within the normal range.
2. Normal hearing acuity as determined by standard five frequency audiometric sweep check test. The frequencies for screening were 250, 500, 1000, 2000, and 4000 cycles per second. A monaural loss of 15 db or more for any of the frequencies noted on two successive tests was sufficient to eliminate that subject from the experiment.
3. Freedom from bilingual home influences.
4. No child was selected who had previously been enrolled in the kindergarten program the previous year.

Four schools in the Modesto city district were selected for participation in this experiment. The schools were selected so as to provide homogeniety with respect to the language and nonlanguage variables. One hundred children, fifty boys and fifty girls, were selected for this group. Since the children were enrolled in kindergarten, it was not possible to obtain language data at exactly the five year level; the age range was limited to 63.0 to 75.0 months. The median age for the boys was 66.5 months, the median age for the girls was 67.5 months.

Audiometric Assessment and Hearing Aid Selection

The procedure utilized at the University of Denver has previously been reported by Stewart and Funaki (1965):

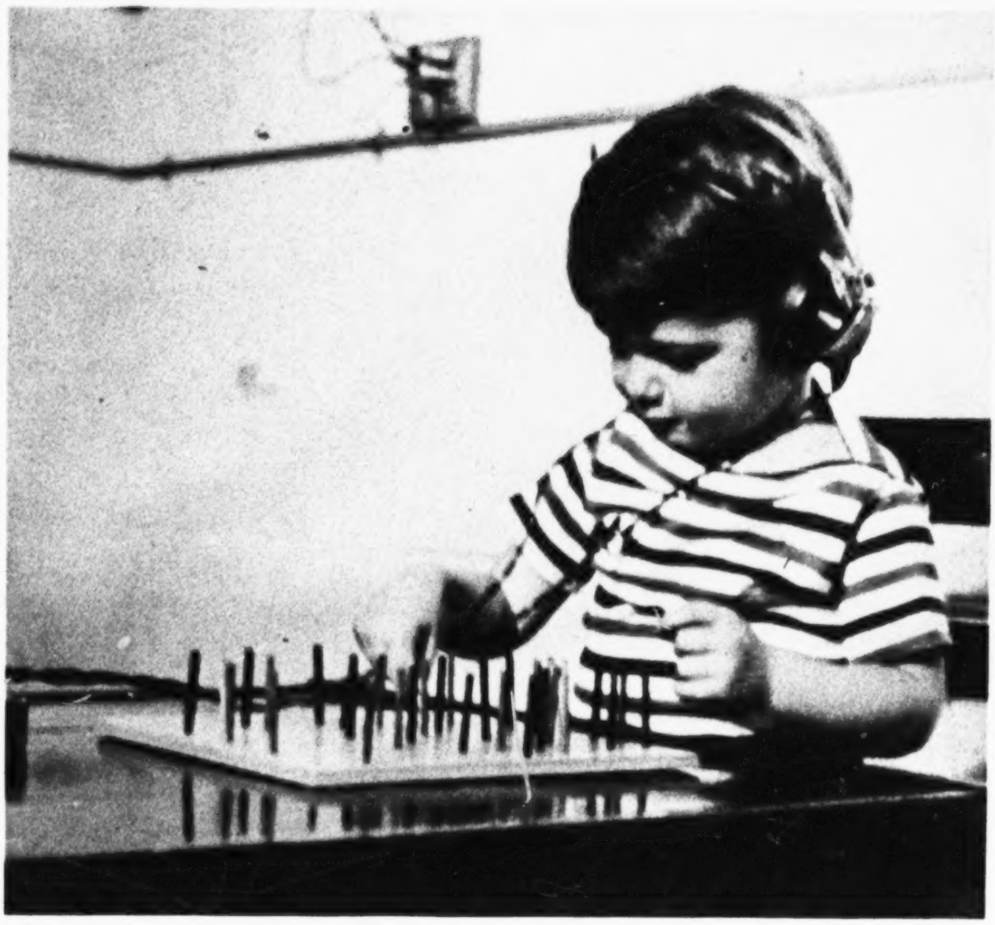
> By the time the child is three years of age, he is evaluated for placement in a nursery school program. The nursery school described is based upon normal hearing nursery school principles and practices. It is felt that the acoustically-impaired child's early education should be patterned along the lines of the normal child rather than along the lines of the exceptional child on the assumption that the child shall eventually be integrated into a hearing world. The evaluation for nursery school

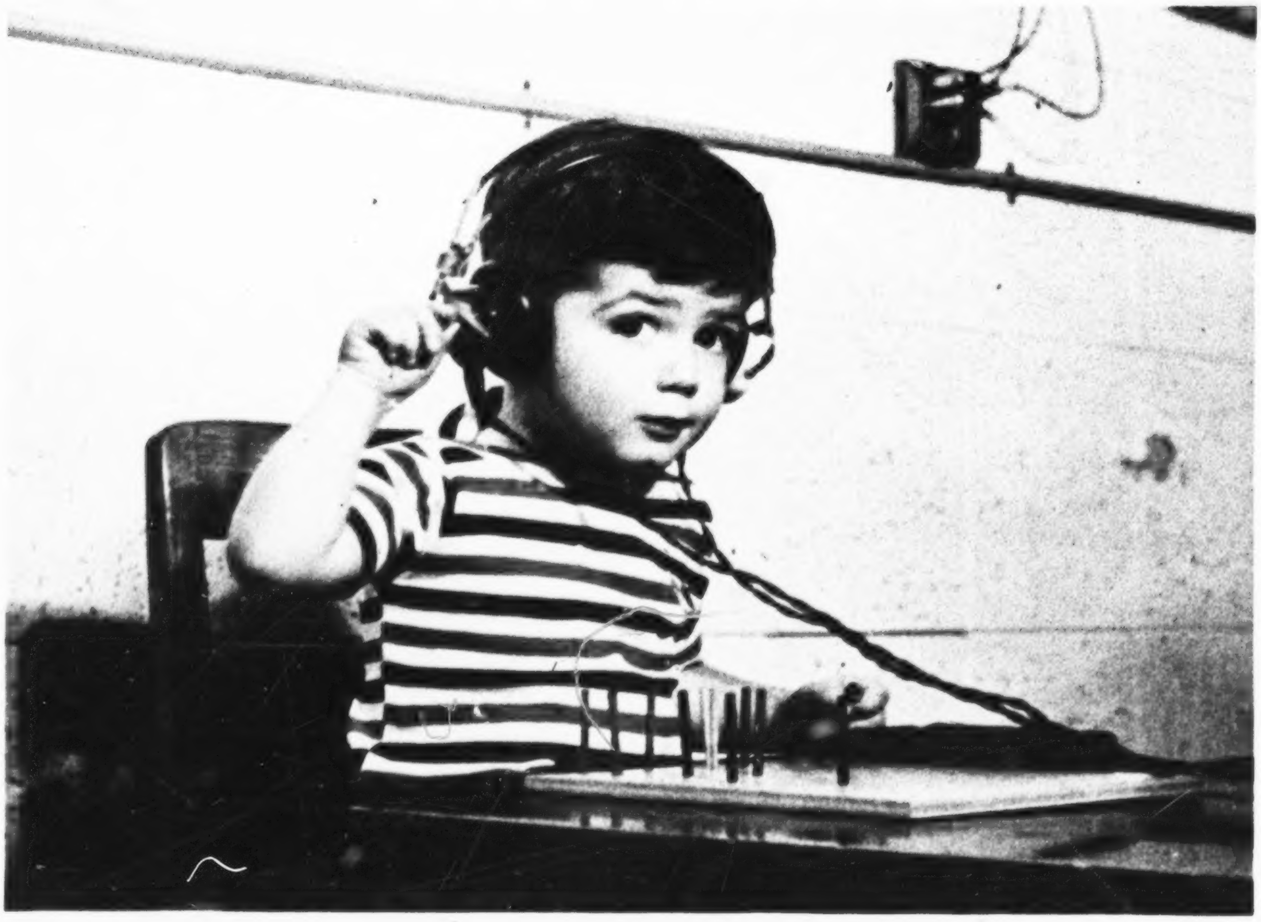
placement is made by the nursery school teacher, the therapy supervisor, and a clinical psychologist. Individual therapy, primarily in language development, continues during the time the child is in nursery school so that each child has a minimum of one half hour per day of individual therapy and two hours in the nursery school. By the time the child is five years of age, it is hoped that the decisions regarding his future school placement may be made and he is terminated from the program at this time.

Of primary importance to the entire approach is the notion that the hard of hearing child should be viewed as a hearing child on the basis of his residual hearing to the extent his hearing residual can be utilized through amplification. The prevalent practice of evaluating the child's hearing potential on the basis of his unaided audiogram should be avoided.

The testing procedure described below, for children under the age of two years, is largely observational. For this reason, it is necessary to extend the testing period over a longer period of time than would ordinarily be necessary. For example, no child is fitted with a hearing aid until he has completed a minimum of ten testing sessions. At the initial session, more gross measures of hearing response are utilized such as high and low frequency noise makers to determine the child's response, if any, to sound. Even an infant will respond with overt total bodily activity to a sound sufficiently above his threshold. These instruments are used primarily as screening devices to establish the general level at which more controlled sound stimuli will be presented later.

A minimum of two audiologists are used at each testing session. Only those responses that both audiologists agree on are scored. An initial test is that of presenting pure tone via the loud-speaker to the child in an inner sound treated room. These sounds are presented at a level well above threshold and the child's reaction to the sound carefully noted. The most commonly observed reactions, which vary with the age of the child, are those of an overall startle reflex, an attempt to localize the sound visually, a cessation of activity, or an attempt at vocally imitating the tone. Testing with pure tones via the loudspeaker is conducted with the realization that what is being measured is the child's response in the





PLAY CONDITIONING AUDIOMETRY

better ear. After several test sessions, pure tone audiometrics using earphones are introduced. This occurs after the child has had several experiences at listening and is more or less accustomed to what will follow.

As a check against the pure tone audiometric results, other sound stimuli are also employed. One of the more successful sets of test material employed are filtered familiar sounds. These are recordings of common sounds which should be familiar to the child (e.g., dog barking, car horn sounding, vacuum cleaner noise,etc.). Series of these sounds are filtered so that the peak frequency for each set corresponds with a standard audiometric frequency. The audiogram depicted in Figure 1 illustrates the relationships between the pure tone results and the filtered familiar sound results. In those cases in which good correlation is not obtained between these two sets of scores further testing is indicated. Conversely, repeated testing in which these sets of scores relate closely indicate the reliability of the testing procedure.

As soon as an approximation of the child's organic hearing level has been established, various hearing aids are used to determine which instrument gives him the best results. At each test session from this time on a different hearing aid is used and these results are scored on an audiogram as shown in Figure 1. At these sessions the child is also seen by a staff member in a therapy situtation and the staff member's observations are then related to the audiometric test data to further corroborate the test results. Toward the conclusion of the testing procedure the two or three hearing aids which are found to have given the best results in the sound room and in the therapy situation are re-evaluated and compared. At this time a recommendation is generally made for the specific hearing aid to be obtained for the child.

The reliability of this testing procedure can best be illustrated by longitudinal study of the children that have been fitted in this manner. Since the first child was fitted in this center in 1952, over 400 children have been evaluated. During this time, only two cases have been found in which the hearing aid recommended was later found to be unnecessary.

The audiogram depicted in Figure 1 shows the relationships between the various testing procedures and how the results should match. This child has a severe, bilateral sensorineural hearing loss, according to this audiogram. While an airbone gap is indicated, the notation (vib ?) is made that the child was probably responding to the vibration of the bone oscillator rather than to perceived sound. The pure tone, earphones, audiogram results correlate very highly with the pure tone, result obtained through the loud-speaker. Further substantiation for the reliability of the audiometric results is obtained from the filtered familiar sounds test, in which the hearing levels were the same as those obtained through earphones and through the loudspeaker.

Comparative evaluation of hearing aids is also possible through this approach. Using warble-tone through the loud-speaker, while wearing his hearing aids, this child shows an overall gain of approximately 35db through the speech frequencies. This result is likewise substantiated by the filtered familiar sounds test.

UNIVERSITY OF DENVER HEARING CENTER

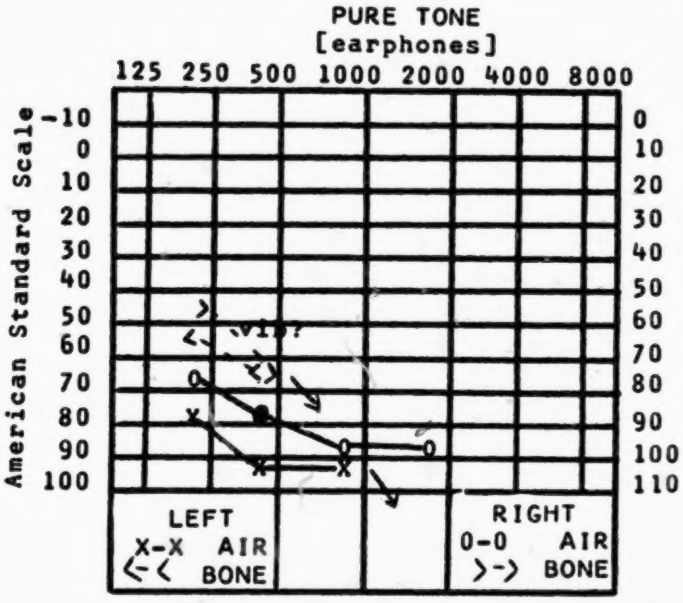
AUDIOMETRIC ASSESSMENT - CHILD

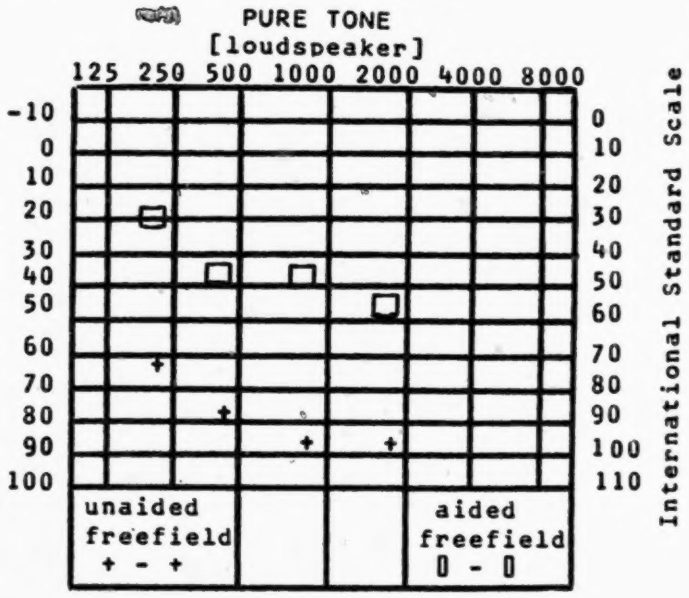
Name: JERRY B. Age: 2 1/2 Date: 8-4-64 Test No. 3

Address: 803 Onandeiga, Denver Audiometer: 15C/GS Tester: JS/MH

Technique: Observation ___ Play Conditioning ___ Volunteered ___ GSR ___ Combination X

Consistency of Response: Good X Fair ___ Poor ___





AWARENESS AND LOCALIZATION

UNAIDED

RIGHT: 65 DB LEFT: 75 DB

LOUDSPEAKER: 60-65 DB

LOCALIZED AT: 75 DB

AIDED

RIGHT: ___ DB LEFT: ___ DB

LOUDSPEAKER: 20 DB

LOCALIZED AT: 25 DB

FILTERED FAMILIAR SOUNDS
[UNAIDED]

CPS:	200-350	400-650	850-1100	1800-2200	3600-4400
RIGHT:DB	65 db	75 db	85 db	85 db	NR
LEFT :DB	75 db	95 db	95 db	NR	NR
BOTH :DB	65 db	75 db	85 db	85 db	NR

[AIDED]

CPS:	200-350	400-650	850-1100	1800-2200	3600-4400
BOTH :DB	20 db	35 db	35 db	45 db	NR

COMMENTS: Aided responses wearing own binaural hearing aids.

FIGURE I.

Results that correlate this well should not be expected the first time the child is tested; a discrepancy between any two of the tests is always an indication that further testing is necessary.

Each child in this research project had his hearing evaluated at least twice a year at six months intervals. These data, and their interpretation as far as reliability of audiometric procedures and changes in hearing over time, are reported in the subsequent section.

Home Instruction

During the hearing aid selection procedures the child and his parents are seen regularly for therapy sessions, as noted above. During this time, the supervisor of therapy instructs the parents on ways in which the work of the hearing center may be supplemented at home. These instructions are based upon the individual child's responses in therapy along with his responses to a given hearing aid. Each parent is given individualized instructions for maintaining this stimulation during the home training program and the child's progress at home as well as during sessions at the center is constantly evaluated.

Group sessions are regularly scheduled in which small groups of parents meet with a member of the Hearing Center staff for discussion centering around the general problem of hearing loss, its effect on the child and his development, what can be expected of a hearing aid, anatomy and physiology of hearing with particular reference to the acoustically impaired child, etc. These sessions are supplemented by the Supervisor of Therapy in individual sessions and by the Clinical Psychologist when such sessions are deemed necessary. The importance of maintaining therapeutic relationship in the home in collaboration with the work being carried on at the hearing center cannot be over-estimated.

Early sessions are generally held not more than twice per week with one half hour therapy sessions coupled with the hearing aid selection sessions. Once the hearing aid has been selected, the child is seen on a regularly scheduled basis for intensive auditory training, with the mother present at all times. At such times as the child has progressed to the point where individual therapy is possible, the child is seen alone and the mother counseled separately on continuation of home training.

Early Group Therapy

As the child gains in his vocal output and presents no problem of separation from the mother he is placed, whenever possible, in a small group for therapy which may or may not be supplemented by individual work if it is deemed necessary. These early beginnings of socialization prepare the child for eventual integration into the nursery school program.

Nursery School

When the child reaches his third birthday, he can be considered for enrollment in the nursery school program. The enrollment of the nursery school is limited to eight children at any given time and their selection for being integrated in the program is based upon a number of factors: maturity, progress to date, independence, cooperativeness, and overall adjustment to hearing aid usage. The decision as to whether or not a child will be placed in the nursery school is made by the Supervisor of Therapy, the Nursery School Teacher, and the Clinical Psychologist after a short period of time in which the child is allowed to attend the nursery

NURSERY SCHOOL ACTIVITIES

school for observation by these three persons.

Historically, preschool education for deaf children in the United States arose from the often-observed need for the child with a hearing handicap to improve his speech and language skills which are typically those most retarded by the handicap of the hearing loss. As a result of this need, these programs have traditionally had as their primary focus the introduction of formal reading and speech training at an early age in order to prepare the deaf child to enter the first grade at the normal age. This was done in an effort to help reduce the extent of his educational retardation. A major drawback to this concept, as reported by Stone, Fiedler, and Fine (1961) was the realization that these children, even with such early formal training, were not appreciably more advanced in language development by the time they entered the fourth grade. In addition, Stone's child development staff at Vassar College noted that these children appeared to show rigid personalities which were attributed to the formality of this early training. Programs of this sort have typically been characterized by a core of speech training emphasizing rather rigorous drills on isolated sounds and single words in an environment of a somewhat structured play program generally supervised by non-nursery-trained personnel. The assumption underlining this type of curriculum seems to be that materials appropriate for a six year old are similarly suitable for a three year old provided they are simplified and made less time-consuming. The failure of this concept was demonstrated by Craig (1964) who found children enrolled in preschool programs in a residential school for the deaf to have no better lip reading and reading skills then those who had not had any preschool program. Craig suggests that a re-evaluation of the goals, admission policies, and educational programs of preschool programs for the deaf child is in order.

In 1948, Stone and his colleagues initiated what they termed an enriched program for preschool deaf children which emphasized learning speech in the context of nursery school play with teachers of the deaf who had received nursery school training. Rather than emphasizing speech drills the teachers were instructed to speak normally to the children in order to stimulate a contextual grasp of speech and communication on the assumption that the children would learn speech more naturally in an environment that would not deprive them of the play experiences which normally stimulate learning in the young child. As a result, reading instruction was postponed until first grade. The second major change of emphasis in this program was the plan to have each child wear an individual hearing aid after he was enrolled in the preschool program.

In order to assess effectiveness of this program, measures of speech production and perception, academic achievement, and personality growth were used to compare a group of children in the new program with a group enrolled in a more traditional program. The group in the new program proved superior in all areas of performances for the measures tested. The authors concluded that the consistent use of individual hearing aids was an important factor in producing superior achievement in speech; they further suggested an interdependence between the teaching method used and the wearing of the hearing aid. Insofar as academic achievement was concerned, as measured by the quantity and quality of the books read by the time this group reached third grade, the more liberal teaching method would appear to be especially important. An overall finding was that the children in the new program achieved better school adjustment and more healthy personality development than children trained in the more traditional manner. The authors emphasized the importance of having teachers who worked with pre-school deaf children not only being trained as teachers of the deaf but also having nursery school training and experience, perferably with totally hearing children.

The teachers utilized in the present project were trained and experienced in nursery school work; with one exception, none had any exposure to either audiology or deaf education. The only "special" instruction given the teachers was to stimulate the children with as much meaningful speech as possible, within the context of the nursery school setting.

Children in this program attended nursery school from the age of three until the fifth birthday; classes were held daily throughout the University year for a period of two and one half hours. One half hour of this time was spent in individual, intensive auditory training with a professional speech and hearing clinician. The balance of the time was spent in the nursery school. The outline below shows a typical sequence of activities and the changes in emphasis in the activities throughout a typical nursery school day:

Planned Play Activities	40 minutes
Dramatic Play	
Playhouse Area	
Block Area	
Jungle Gym & Rocking Boat	
Planned Music	20 minutes
Singing	
Listening	
Creative and/or dramatic rhythms	
Rhythm instruments	
Outdoor Play	45 minutes
Nourishment and Rest Period	25 minutes
Story Time	20 minutes
Flannel Board Stories	
Books	
Hand puppets	
Creative dramatics	

The actual scheduling of events and activities was purposely very flexible and subject to change whenever indicated by the children's spontaneous interest, attention spans, and weather conditions which may limit or modify outdoor play. Throughout the year special parties were scheduled which related to national holidays, and special events in the children's lives. Field trips were undertaken when possible.

The activities can be seen to stress interaction among the children and yet provide the child with enough flexibility to follow his own interests. The emphasis upon audition is purposeful with a music period and story time both being utilized with idea of providing the children with basic sense of rhythm and melody as well as large groupings of meaningful speech.

Parental Guidance and Psychological Counseling

During the third and fourth years the Project had the services of Esther Shapiro, Ph.D., in the capacity of half-time Clinical Psychologist. While not called for in the original application, the services of a psychologist were felt to be desirable both from a clinical as well as experimental standpoint.

Parental cooperation in this program is felt to be a very necessary prerequisite to any success achieved under this approach. Initially, the mothers were

2

expected to attend this series of orientation meetings dealing with the physiology of hearing, interpretation of audiograms, growth of language, and emotional development as it pertains to the hard of hearing child. These lectures, which allowed for discussion periods, were designed to provide the parent with a better overall understanding of the child's problem and were not designed to be therapeutic or supportive, but rather to be informative. At the same time, the parents were requested to attend one or more observation sessions during the course of the quarter at which time they would observe the children in the nursery school through a one-way observation mirror. Further appointments were scheduled with the Supervisor of Therapy for individual instruction, as noted above, to supplement at home the program of the Hearing Center.

The children in the nursery program, who ranged in age from three to five years, had sustained a hearing loss sometime prior to coming to the clinic and all wore either a monaural or binaural hearing aids. As mentioned above, the children participated in free play, music, storytime, etc.; the only difference between this program and normal hearing children's nursery programs was the half hour each morning spent in individual therapy.

During the first year of the psychologist's participation in the program, the orientation and observation periods remained as they had in the previous years, with the exception of arranging the observation sessions on an individual basis in the presence of the psychologist. Most of the mothers used this time to comment on the behavior of their children and other children in the program and frequently raised questions relating to the handling of a hard of hearing child. It was evident that they, similar to mothers of normal hearing children, expressed the same wishes and concerns for the child: namely, wanting the advantages of the nursery school in regard to developing peer relationships, intellectual stimulation and gain in self-confidence. At the same time, many wondered how their child adjusted to the separation from the mother and how well the child was getting along in school. Other problems also were evidenced. The teacher and the supervisor of therapy, having more frequent contact with the child and mother, were not only consulted as to the progress of the child but often asked for help in the handling of certain problems which many mothers felt were directly or indirectly associated with the hearing loss. It became apparent that there was a need on the part of several of the mothers to talk about the child and the mother's role in relation to the handicapped. This then led to the establishment of a parental guidance program on a bimonthly basis with the psychologist.

These sessions were of a voluntary nature and were offered to the mothers in an attempt to help them reach solutions to the many problems they are posed with in regard to the handling of their children. Because of the voluntary nature of the program, the number of interviews per mother vary. All came for the first three sessions, and some continued on a relatively regular basis for the academic year. Each mother was told that the primary purpose of these meetings was to help her to achieve a better understanding of the child which all seemed most desirous of obtaining. Initially, these interviews were concerned with the detection of the hearing loss, the frustrations and fears experienced by the mothers, the variety of ways in which they attempted to test their suspicions, etc. Most recalled the procedures which they followed until such time as the hearing loss had been confirmed. In some instances, there was a time lapse of several months, either due to difficulty in scheduling appointments or to the lack of definitive medical or audiometric findings to corroborate their suspicions. Some mothers related feelings of confusion, disbelief, and/or despair and, in retrospect, they were not quite sure how they managed their daily activities. The period between the first suspicion of a hearing loss and its confirmation was filled with ambivalence, desire for confirmation of their suspicion and yet hoping that they were mistaken. Most had had little contact with problems associated with hearing loss and many felt varying degrees of guilt, apprehension for the so called "normalcy" of the child and doubts regarding the child's future. They all stated that once the hearing loss had been confirmed that acceptance of of the handicap followed and they proceeded to seek professional help for the child. Most also helped themselves by reading and talking with others who had similarly handicapped children.

The problems most frequently reported by the mothers were two-fold: how to communicate with the child and how to discipline him. While these problems are not peculiar to the hard-of-hearing child, the nature of his handicap seem to make the mother feel that what one normally takes for granted in the totally hearing child suddenly presents great difficulty with the result that frequently both the child and the parent were extremely frustrated. The inability to communicate one's desire resulted, for the child, in temper tantrums, destruction, and sullenness; for the parent the result was anger, helplessness, and guilt. Many parents frequently felt that disciplining was either too severe or too lenient and that it lacked consistency. Many parents related that the child was unable to handle frustration in its mildest form and this they attributed to the hearing loss. They expressed uncertainty in dealing with the child, excusing him for misbehavior on one hand while expecting him to behave as a hearing child on the other hand. In many instances, it seemed that they hoped that as the child learned language he would be easier to discipline.

In many cases outside pressures on the child were superimposed on the child-mother relationship. Relatives and neighbors frequently entered into the mother's frustration by offering advice, making excuses for the child, or reassuring the mother that the misbehavior would diminish with age. In those cases in which there were normal hearing siblings, additional problems were evident, such as how to inform the other children about getting along with the hard-of-hearing child, when they should acquiesce, and when they should be firm. Other problems were also raised such as the effect of the extra attention and time given the hard-of-hearing child in relation to the other children. Many similar questions were asked and occasionally direct answers were given. More often, the questions were rhetorical in nature. Those requesting direct advice showed little evidence of being able to cope with simple suggestions and soon missed appointments because of other commitments.

Because the number of mothers who participated in these sessions were rather limited, no conclusions were reached for the group as a whole. However, this pilot study would suggest further investigation of a parental guidance program to ascertain more fully the role of the parent in conjunction with the progress of the child. The child's needs are generally being met in the program through the nursery school teacher and the professional clinician. The mother's needs, in some cases, seem to extend beyond an intellectual understanding of the act of communication. Toward this end, individual sessions may have helped develop a depth of understanding which stem from the removal of anger and helplessness felt in dealing with the child.

Several cases in which the psychological counseling played a major role are discussed in greater detail below.

RESULTS AND DISCUSSION

Of the 33 children selected during the course of this project as being suitable for inclusion in the research, terminal data were obtained from 12 children at the age of five years. Of the remaining 21 children considered in this study, eight had not yet reached the fifth birthday at the time the study was concluded, nine others were enrolled in public school programs in the

Denver metropolitan area prior to the fifth birthday, two moved out of the Denver area, and two dropped out of the program to be re-enrolled at a later date.

Two sets of data are presented in this section. Data pertaining to case history findings, audiometric assessment, and hearing aid selection are presented for the total sample; analyses of language and speech data are presented for the 12 terminal subjects.

Case History Data

A coded case history was devised for use of the project for ease and rapidity of scoring responses. Data obtained from the final form of this case history are presented in Summary Table I, Appendix A. A number of items in previous forms of the history which were found to obtain less than satisfactory information have been ommitted in the final form presented here.

Of the 33 children considered for the project, 18 were boys and 15 were girls. The mean age of the children at the time the interview was obtained was 36.9 months. The mothers' mean age was 28.7 years and the fathers' mean age was 32.5 years. In 31 cases the mother served as primary informant; in one case a stepmother was the informant and in one case the father. Ten of the children were referred by otologists, nine by family physicians other than otologists, nine from the University of Colorado Medical Center, two were self-referrals, two were referred by the local school system, and one child was referred by a university outside the State. For 15 of the children a hearing loss had already been confirmed at the time the child was referred; in 13 other cases the hearing loss was suspected but not confirmed. Two children were referred because of speech retardation and three more for a combination of hearing loss suspected or confirmed coupled with speech retardation. Nine children were referred for diagnosis only, 13 for diagnosis and therapy, 11 for therapy only. In 10 of the children, the loss was felt to be congenital and in 18 more was believed to have existed prior to the child's first word. In the five remaining cases, the hearing loss was felt to have been incurred during the early stages of speech development. The mean approximate age when hearing loss was first suspected was 15.6 months. The reason for suspecting hearing loss was retarded speech in nine cases, the lack of startle response in eight cases, no response to auditory stimuli in nine cases and a combination of all three of these factors in seven cases. As might be expected, in the majority of case it was the mother who first suspected a hearing loss. This was the case for 25 of the children with the father being the person first suspecting it in two cases, a grandmother in two cases, the family physician in two cases, the hearing clinic in one case, and a neighbor in the final case. When asked whether any change in the progress of the hearing loss had been noted since its first being suspected, 25 informants indicated no change of hearing, two felt that it had gotten gradually worse, three felt the hearing had gradually improved, and three had never made a comparative evaluation. In light of the possibility of the hearing loss being genetic or hereditary, it was deemed important to investigate whether others in the family also had hearing impairment. In 29 of the families there was no other person with a hearing loss with the exception of elderly grandparents who had shown decreasing hearing acuity with age. In one case a brother and sister were both enrolled in the program and in one case an older sister also had a hearing loss. This child also had a maternal aunt and uncle with otosclerosis. One other child's maternal grandparents and maternal uncle had severe losses of hearing felt to be hereditary and one child had a maternal grandmother and great grandfather who had histories of early hearing loss. Another child's younger siblings, born after the initial interview, were being evaluated for probable hearing losses at the time the family moved from the city.

The mean number of siblings reported was 2.03. In two of these families other children in the family were found to have problems of congenital origin; in both of these cases the problem was hearing loss.

The general health of the mothers during pregnancy was indicated to be excellent in 20 cases, good in eight, fair in three, poor in one, and very poor in one. Nineteen of the mothers indicated no diseases during this pregnancy and five indicated having had rubella. In one case rubella was during the first five weeks of pregnancy; in another between the third and fourth month, and in a third rubella was assumed. In this case, the mother had sought medical treatment for a mild rash which was not diagnosed but, upon confirmation of the child's hearing loss, was felt to have been rubella. Five of the mothers reported having influenza during this period while one had influenza and a strep throat. Another reported strep throat only and there was one case each reported of toxemia and a generalized kidney infection. Twenty-five of the mothers reported they had not taken any medication during pregnancy other than anti-nauseants, calcium dietary supplements, etc. Nine of the mothers had previously suffered miscarriages with one mother each reporting two, three, and four previous miscarriages. The mean length of pregnancy was 40.3 weeks, a figure which is not felt to be reliable since many informants calculated this time period by multiplying nine months by four. According to the gestation periods reported, none of the children would be classed as premature; on the basis of birth weight, however, one would be so considered if the criterion measure of birth weight less than five pounds is used. The mean length of time the mother was in labor was 7.45 hours with a range of from less than one hour to 32 hours. Due to lack of standardization of definition of how labor is determined from one case to another this figure is also felt to be somewhat unreliable. Labor was induced in four known cases, was not induced in 27 cases and in one case the mother did not know whether or not labor was induced. Twenty-seven of the births were head presentations with one each of foot and breach presentations; two children were delivered by Caesarean section and in the final two cases the details of the delivery were unknown. Forceps were known to have been used in seven cases, were not felt to have been used in 18 cases, and whether instruments were used or not was unknown in eight cases. In twenty-eight cases there was no cranial birth injury noted; severe cranial injury was noted in two cases and moderate, slight, and unknown birth injury in one case each. In 19 cases there were no congenital anomalies noted, in 13 cases it was not known whether there were any other congenital problems, and in one case a child was diagnosed as having a peripheral nerve palsy at birth. Two children, previously in the unknown category were later found to have urinary tract anomalies and one of these was also found to have other problems, such as missing musculature, as well. No other conditions were present at birth in 25 cases, two were reported to have difficulty in initiating breathing, three were cyanotic, one was anoxic, and in two cases it was not known whether other conditions were present at birth or not. One of these cyanotic children was found to have erythroblastosis and was retained at the hospital for 15 days in an incubator. Another of the cyanotic infants was found to have anemia also. In 23 cases the parents were known to be Rh compatible, were known to be Rh incompatible in eight cases, and in two cases this information was not known.

The mean birth weight of these children was 107.41 ounces.

In most measures of motor skill development, the hearing impaired children were found to be slightly slower in development than results published for totally hearing children, compared to the norms published in Johnson, Darley, and Spriestersbach (1963).

The mean age when project children sat alone was 6.6 months compared to an average age reported of 6.2 months. The mean age for crawling for project children was 8.7 months compared to a norm of 7.3 months. Project children averaged 13 months when they took their unassisted step compared to a mean of 12 months for totally hearing children. These differences, while slight, might be worthy of further investigation in light of the known inner ear pathology and its possible effect on balance.

Twenty-four of the project children were deemed by their parents to have spoken at least one meaningful word. The mean age for this event was 17.8 months. Darley and Winitz (1961) have reported the unreliability of first word as a language measure, but even so these children, predictably, are found to be retarded in this phase of speech development. Only 12 project children have been judged to have spoken short combinations of words with the mean age being 26 months. Nine children were evaluated as having spoken short sentences, the mean age being 35.3 months. As might be expected, a large number of parents had concern (21) over the child's speech adequacy; five informants felt the child's speech was adequate while seven reported the child's speech had never been evaluated.

Insight into parental attitudes toward the child with the hearing handicap might be inferred from the information reported regarding toilet training. Of 24 children from whom bladder training had been initiated, the mean age in months for such initiation was 21 months; this compares with a median figure of 12 months for boys and nine months for girls reported in the normative studies. Bladder training was judged to have been completed at an average of 29 months for project children compared with 21 months for boys and 16 months for girls in the normal population. Bowel training for project children was initiated on the average by 20 months compared to seven months for boys and six months for girls in the total hearing population; bowel training was judged to have been completed on the average by 28 months for project children and was judged completed by 16 months for boys and 12 months for girls in the normal population.

The disease history for project children reveals an extensive range of childhood diseases and combination of diseases. With the exception of one case (measles followed by meningitis) there was little, if any, relationship between the child's history of disease and the hearing loss. In one case, severe illness at 18 months which was treated with a drug known to be ototoxic was suspected as possibly accounting for a worsening of the hearing loss but the relative effect of disease and drug were not assessed.

Because of previous investigations relating allergic conditions to hearing loss, each informant was asked whether or not the child was allergic. Twenty-six informants indicated no allergy, three indicated some allergic condition judged by the physician to be severe and no relationship between hearing loss and allergy was attempted. Since a mixed loss had been noted in many of the children it was felt important to determine the frequency of middle ear infection. Six informants reported the child had frequent hearing difficulty due to infectious conditions with 13 each reporting these rarely or never. In one case this information was unknown.

Audiometric Data

The mean age at which the total sample of children were suspected of having a hearing loss was 15.6 months with a range of from zero to thirty-six months. The mean age at the time of the child's first audiometric test was 25.4 months with a range of from eleven to forty-four months. The mean age at which time a hearing aid was recommended was 29.4 months with the range of eleven to forty-five months. A comparison of the mean scores indicates a considerable lag between the time the hearing loss was first suspected and the time of the first audiometric test. Informants reported a variety of reasons for the delay. Among these reasons: advice from the pediatrician that the child either did not have a hearing loss or that he was too young to test audiometrically; advice from the informant's own parents or other interested parties that they were imagining a hearing problem and that nothing was wrong with the child; a hesitancy on the part of either or both parents to acknowledge recognition of the possibility of hearing loss which in turn led to procrastination in arranging for hearing tests. Many of the informants reported not knowing what to do once the suspicion was present. The person most often turned to was the family physician and, more especially, the pediatrician. By and large, the pedictricians involved showed lack of recognition of either the possibility of early audiometric assessment or an ignorance of the indications that a hearing loss might be present such as lack of speech development, erratic or inconsistent responses to sound, lack of startle response, etc.

On _a priori_ grounds it would have been expected that a significant correlation would exist between the extent of the hearing loss and the age of the child at the time of his first audiometric test. A Pearson _r_ run between these two sets of scores for the terminal group resulted in a -.1572 score which was not significant at either the one per cent or five per cent level of confidence. Perhaps the factors cited above were sufficient to disrupt any such relationship.

Due to the difficulties, cited previously, inherent in the audiometric testing of young children, it was assumed that, barring any progression in the hearing loss, the children would show progressively better audiograms with succeeding tests. This assumption was based on the observation that with increased practice and experience at the task, children would be found to be progressively better listeners and that the indicated improvement of hearing would be, in actuality, an improvement in detecting threshold rather than reflecting any actual change in hearing level. Based on observations (prior to the study), it was felt that an initial audiometric evaluation would be 15 to 20 db poorer than the true organic hearing level which would be determined with subsequent tests. A Pearson r run between the three frequency average for the better ear at the time of final test for the terminal children was found to be significant at the .01 per cent level of confidence. The mean hearing loss at the time of first test was 65db and at the time of terminal test was 93 db with, on the average, 29 months interceding between the first and last test. From these figures it can be readily seen that the direction of change was from better to worse rather than the contrary. At least two factors are felt to be responsible for this: (1) evidence on the part of at least three of these children that the hearing loss was gradually becoming progressively worse and (2) lack of inter-audiologist reliability. The same two audiologists were not involved in all of the testing reported and inspection of the data indicates that in those cases in which progressive hearing loss was not felt to exist the primary member of the initial evaluating team tended to be optimistic in her scoring of observed responses

A more detailed analysis of the audiometric findings in selected cases and the implications drawn from these data are presented in greater detail in the following section, devoted to detailed case data and analysis. Serial audiograms, from which the test to test variation may be observed, are presented along with serial language test measures for all children and are presented in Summary Table II, Appendix A.

In summary, the reliability of early audiometric measures, even based on observed behavior responses, seems to be established in this study. The audiologist, however, must continually be on guard against allowing a hoped-for response to interfere with his objectivity; this is one further indication for the need for two audiologists to test a given child over as many appointment sessions as necessary for the test results to be adequate enough to make future commitments upon.

Terminal Subjects

The children in the following discussion are the twelve terminal subjects for whom complete data are available. Each child is referred to by initials, not his own, since complete anonymity was guaranteed each parent. Detailed information based upon the parental interviews conducted by the clinical psychologist are presented for the first four cases. In two of these cases, the child was judged to have been an outstanding success insofar as the educational approach being utilized was concerned. The remaining two cases were felt to be outstanding failures insofar as this approach is concerned. In order to assess the factors which might influence relative success or failure, as many factors as could be evaluated are included.

Subject AB: AB was first seen in the clinic at 17 months of age; her parents were both in their mid-thirties and had three older children, all girls. The parents were referred by an otologist for therapy in the clinic since the hearing loss had been confirmed. AB was six months of age when her mother first suspected a hearing loss because of the child's lack of response to auditory stimuli. There is no one else in the family with any history of hearing loss and there was no indication in the mother's health and medical history during pregnancy to indicate a prenatal disease or drug factor to be accountable. The mother was in an automobile accident during her eighth week of pregnancy and the family physician felt this might have had some effect on the child's hearing but that there was no way that this might be definitely ascertained. The pregnancy was of normal duration with labor being induced at approximately the fortieth week; the child's delivery was uneventful with no difficulties being experienced during birth and no indications that the child had in any way suffered birth damages. AB's motor development was essentially normal in that she sat alone at six months, never crawled or crept, and took her first unassisted steps at sixteen months. Her first judged meaningful word was spoken at seventeen months, one month prior to the initial interview. AB had not spoken in short combinations of words at this time and her speech was evaluated as adequate for her age. Toilet training had not been initiated for this child at this time. AB's own health history was remarkably free from severe illness or injury with ear infections during the winter months of the previous year being reported; the mother stated that the child had such ear infections frequently during this time. AB occasionally was noted to face speaker in order to understand and showed awareness of such sounds as her parent's voices, the doorbell, and telephone. In the opinion of the interviewing clinician, this child had not reached even the primary level of sound development.

AB began wearing a hearing aid at 18 months so that she had worn the instrument a total of three and one half years at the time the terminal data, reported on the following page, were obtained.

AB shows a number of factors which should lead to exceptional speech and language development. For example, her hearing loss, while handicapping, could not be classed as worse than moderate; further, she had good residual hearing in one ear through 8000 cycles and in the other through 4000 cycles with hearing

Subject: AB
Age: 5.0 years
Length of amplification 44 months
Aid: binaural ___ or monaural X
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	55 db	58 db
Hearing measurable up to and including:	8000 cps	4000 cps

Of 50 responses:
mean length of response: 2.04
number of 1-word responses: 26
mean of 5 longest responses: 5.2
number of different words: 65
structural complexity score: 10
mean structural complexity (MSC): .02
number of agreed on responses: 50
number of agreed on words: 10
Of these agreed on words there are:
nouns: 37
pronouns: 14
verbs: 24
prepositions: 3
adjectives: 0
adverbs: 11
articles: 7
interjections, etc.: 6
other: ___

Templin-Darley score 49 on screening test

Peabody: Form A _____ Form B 91
Ammons: Form A 24 (5.5 years) Form B _____

I.Q. score: 125 test: Leiter

Vineland score: S.Q. 156; S.A. 7.8

Socioeconomic classification: II

somewhat better in the high frequencies. (Complete audiometric data are presented in Summary Table B, Appendix A.) In addition, her hearing loss was suspected early and she was wearing a hearing aid at a relatively young age.

The speech and language data (with the exception of the absence of adjectives) shows exceptionally complete speech for a child with a hearing loss. As might be expected, her speech is predominantly nouns and verbs. The score of 49 on the screening portion of the Templin-Darley articulation tests is exceptionally good when compared with the cutoff score of 31 for a totally hearing child.

While other aspects of speech and language are felt to be exceptionally good, AB is noted not to have performed in the superior range insofar as the vocabulary tests are concerned. The Peabody score, when judged as a measure of intelligence, is of particular interest when compared to the IQ of 125 on the Leiter and the Social Quotient of 156 on the Vineland.

Soon after AB was enrolled in a nursery school program, her mother was scheduled for regular conferences with the clinical psychologist. A total of ten such appointments were arranged during the first year of AB's nursery school enrollment. The first three interviews were interrupted when AB fell from a playhouse in Sunday school and sustained a slight brain concussion. The interviews dealt with AB as her mother sees her: determined, bossy, friendly, talkative, and babied. The mother regarded none of these characterizations as problematic and felt that some were due to the child's lack of playmates and others to her status as the youngest of four daughters in the family. When AB was hospitalized, her mother reported she was not able to communicate with the staff without her hearing aid which she was not permitted to wear. The mother observed, however, that despite this the child spoke as much as ever.

The next four interviews were concerned with plans for the summer in which the mother expressed some concern over her child's understanding of street-crossing and outdoor play. The mother had compiled a list of 300 words which constituted AB's speaking vocabulary at the time and expressed considerable pleasure at her progress to date. She compared AB with her other girls and felt that this child was better adjusted, more obedient, and exhibited none of the fears of water, animals, etc. that her other children had at this age.

During the eighth interview the mother, for the first time, spoke of herself and her child's hearing loss. The psychologist felt that during this interview the mother was less deceptive about the child's handicap and perhaps recognized the child as an individual rather than as an extension of the other girls and, in particular, the girl immediately older than AB. Because this sister was fearful, clinging, and shy, the mother had expected AB to behave similarly and expressed pleasure that she did not. It was during this interview that the mother mentioned that she had not worked with AB at home as much as had been expected and, while she expressed some guilt over this, felt that there was sufficient speech in the home so that AB never lacked for auditory stimulation. The mother felt that she took advantage of ordinary daily situations to talk with AB and was in this way able to teach her much as one would with a totally hearing child. The mother did not feel that AB perceived herself as being any different from the other children; as soon as she awakens each day, the child asks for her hearing aid and proceeds to take part in family activities. She shows good awareness of sound and responds appropriately from any part of the house.

The final two interviews were conducted after a six weeks break during the summer. The mother reported that AB had presented no particular problems during this time and that relatives who had not seen her for some time were delighted with her ability to carry on conversations. Two weeks before the final interview, AB became ill, had convulsions, and was hospitalized for study. This episode was attributed to the head injuries she had suffered several months previously but when the child returned to nursery school she showed no regressions from her previous levels of achievement.

The clinical psychologist noted that AB had showed remarkable language growth, was an independent, social, winsome child, who related very well to adults and enjoyed receiving the attention of her peers. As the youngest child in the family she frequently was the center of attention and responded very well to this attention. Although her mother noted that she had not been diligent in her work with AB at home the household is not a quiet one and much talking to and around AB goes on. She was brought to the nursery school quite regularly and was always very vocal about making her needs known.

At the conclusion of her enrollment in the nursery program, AB attended regular kindergarten and, at last report, was considered to be doing very well in a class with 36 other children; her teacher especially noted her exceptional reading ability.

Subject BC: BC was first seen at the clinic when he was 37 months of age, having been referred from a local medical center following confirmation of his hearing loss and the fitting of his hearing aid. His parents were both in their early thirties with no other children in the family. BC was first suspected of having a hearing loss at eight months of age by his mother when he showed no response to auditory stimuli. There was no history during the mother's pregnancy, of 38 weeks duration, to indicate any definite etiology for the hearing loss. The only diseases the mother had during pregnancy was one case of what was felt to be hives at six weeks but which the family physician later felt might have been a mild case of rubella; in all other respects the health of the mother during pregnancy was excellent and there was no medication taken during pregnancy which might have accounted for the hearing loss. The child's delivery during birth was normal with no cranial birth injury, congenital anomilies, or other conditions reported at bith. The parents are Rh compatible.

Insofar as motor development is concerned, BC sat alone unsupported at seven months, crawled at ten months, and took his first unassisted steps at sixteen months. He was judged to have spoken his first meaningful word at twenty-seven months, his first short combination of words at thirty-six months, and his first steps also at thirty-six months. The latter two speech skills were obtained after he had been fitted with his hearing aid. The parents considered BC's speech adequate for his age considering the extent of his hearing loss.

Bladder training was initiated at thirteen months and was reported to have been completed at thirty-seven months; bowel training had also been initiated at thirteen months and was not completed at the time of the initial interview.

BC had suffered no serious childhood diseases, had never had a serious accident, and was not known to be allergic. His mother reported he had middle ear infections rarely and had never had a discharge from the ear during ear infections. BC had never had his tonsils or adenoids removed, never had other surgery, and had never taken any drugs other than small quantities of aspirin.

BC was observed to face the speaker in order to understand relatively often and did not appear to be aware of any environmental sounds without amplification. The clinician felt that BC had obtained the primary and vocal levels of speech development but had not yet attained the symbolic level or the aural level.

BC had worn his binaural hearing aids a total of thirty-seven months at the time the terminal data, reported on the following page, were obtained.

As contrasted with AB, BC shows a severe hearing loss which would, by many classifications, label him to be "deaf." He does show, however, residual hearing in both ears through 4,000 cycles although his hearing at 1,000 was not measurable with any consistency. While his hearing loss was suspected early, he was not fitted with a hearing aid until one year and eleven months of age.

The speech and language section indicate language development to be somewhat retarded in that BC, at the time these data were obtained, utilized nouns only. His Templin-Darley score of eleven compares with the cutoff of 31 for a totally hearing child. His articulation difficulty is further reflected in the number of agreed on responses and the number of agreed on words. A further indication of this child's retarded level of speech and language development, compared to the

Subject: BC
Age: 4 years, 11 months
Length of amplification: 44 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	90 db	90 db
Hearing measurable up to and including:	4000 cps	4000 cps

Of 50 responses:
mean length of response: 1.06
number of 1-word responses: 14
mean of 5 longest reponses: 1.2
number of different words: 11
structural complexity score: 0
mean structural complexity (MSC): 0
number of agreed on responses: 15
number of agreed on words: 16
Of these agreed on words there are:
nouns: 16
pronouns: ___
verbs: ___
prepositions: ___
adjectives: ___
adverbs: ___
articles: ___
interjections, etc.: ___
other: ___

Templin-Darley score: 11 on screening test

Peabody: Form A 70 Form B ___
Ammons: Form A 3.9 Form B 3.3

I.Q. score: 92 test: Leiter
score: 105 test: Merrill-Palmer

Vineland score: S.Q. 156; S.A. 7.7

Socioeconomic classification: II

totally hearing child, is the Peabody score of 70 and the two Ammons scores of 3.9 and 3.3; these scores, when considered as measures of intellectual capacity, are somewhat below the Leiter scale score of ninety-two. Inconsistency of such tests when utilized for this purpose can be seen when compared to the score of 105 on the Merrill-Palmer and Vineland scores.

In common with other mothers of children in the nursery program, BC's mother attended eleven sessions with the clinical psychologist during the first year of his enrollment in the nursery school. The initial interviews were primarily concerned with the mother's anxiety over BC's lack of complete toilet training. Midway through the year, however, training was completed and the mother was able then to relate her concern over the child's hearing loss. During the time the child was being evaluated for hearing loss, his mother became physically ill and was told by her physician that increased tension concerning the child's hearing loss was the major cause of the illness. During the period of parent counseling she frequently compared BC's present behavior with that of the prior year or two and recognized that her own frustrations were due to both a fear for what his life would be like and coping with the ever-present problem of trying to communicate with him. Once the diagnosis has been confirmed and steps taken to enroll BC for speech training, she felt that the major obstacle had been overcome and there was some real hope for her child.

Mrs. C demonstrated great patience to the psychologist and together with her husband she worked extensively with the child to provide as much meaningful auditory experience for him as possible. The parents remained firm in their discipline of the child regarding street crossing and fence climbing but had difficulty enforcing discipline for less serious behavior.

Subject CD: CD was first seen at the clinic at thirty-five months, having been referred by a local medical center which had confirmed a bilateral hearing loss. The parents were fifty-five and forty-one years of age and CD was the youngest of nine children. CD was suspected of having a hearing loss by his mother at twenty-seven months primarily due to his speech retardation.

The mother reported her health during this pregnancy to be excellent, the only illness being influenza at seven and one half months; there was no history of any medication being taken during this pregnancy which was of forty weeks duration. The birth history on this child was essentially normal with only a slight birth injury to one eye being reported; there were no congenital anomalies noted and no debilitating conditions present at birth. The parents ar Rh compatible.

Insofar as motor development is concerned, CD sat alone unsupported at six months, never crawled or crept, and took his first unassisted steps at twelve months. He was judged to have spoken his first meaningful word at fourteen months but had not progressed beyond this point at the time of the initial evaluation. The parents expressed concern over his inadequate speech.

CD was eighteen months of age when bladder training was initiated, this training being completed by thirty months. Bowel training was initiated at eighteen months and had been completed by twenty-four months.

The only childhood disease reported, at the age of thirty-five months, was measles and the child had never sustained a serious accident nor was he suffering from any allergenic conditions. CD rarely had middle ear infections and rarely had discharges from the ear during such infections. He had neither a tonsillectomy nor adenoidectomy. The only drug ever taken, other than small quantities of aspirin, was reported to have been penicillin.

CD was reported to very often face the speaker in order to understand and showed no response to any environmental sounds without amplifications.

This child was judged to have attained the primary and vocal levels of development at the time of the initial interview but was uncertain as to whether or not he had attained a symbolic level.

CD began wearing his hearing aids at thirty-five months and had worn them a total of twenty-five months at the time the terminal data were obtained.

CD shows a number of factors which might account for the fact that he would be considered a failure insofar as the educational audiology approach is concerned.

Subject: CD
Age: 5 years, 1 month
Length of amplification: 25 months
Aid: binaural __ or monaural X
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	77 db	58 db
Hearing measurable up to and including:	4000 cps	4000 cps

Of 50 responses:
mean length of response: 1.46
number of 1-word responses: 32
mean of 5 longest responses: 3
number of different words: 12
structural complexity score: 0
mean structural complexity (MSC): 0
number of agreed on responses: 50
number of agreed on words: 73
Of these agreed on words there are:
nouns: 59
pronouns: 1
verbs: 1
prepositions: 0
adjectives: 0
adverbs: 0
articles: 0
interjections, etc: 12
other: __

Templin-Darley score No Response on screening test

Peabody: Form A 70 Form B ____
Ammons: Form A 2.5 Form B ____

I.Q. score: 92 test: W.I.S.C.

Vineland score: S.Q. 129; S.A. 6.6

Socioeconomic classification: II

His hearing loss, for example, is severe and, without intensive home training, would not be indicative of good auditory awareness even under amplification. The residual hearing through 4,000 cycles, however, should have indicated better hearing than apparently is the case with amplification.

The speech and language section reveals a relatively large number of agreed on responses and agreed on words but is misleading in that there were only twelve different words used and the majority of the words were nouns. CD's response to the test situation during the articulation screening is indicative of his performance on tests in general. The clinical psychologist noted "the examiner was unable to enlist cooperation in any way; each of the sessions was thirty to forty minutes in length and although it was felt that CD had reached his peak of performance, it is possible that may have achieved another item or two. Subsequent attempts to reach him brought forth an immediate headshaking (no) and an absolute refusal to participate. This behavior is characteristic in that unless he wants to cooperate he will withdraw from the situation and sit morosely by, waiting until he is allowed to do as he wishes." Insofar as the vocabulary tests are concerned the psychologist noted that his inattentiveness and general lack of concentration shown with regard to formal learning situations seems to be reflected in this score. Somewhat higher scores are noted for the WISC and Leiter scales with the Vineland score being superior to all others.

CD's parents had moved into the Denver area following the discovery of his hearing loss in order that he might have the benefits of preschool training and special education facilities offered through the various school systems.

CD's mother was seen over a period of eight sessions during the first year in which her child was enrolled in the nursery school. Initially, the psychologist felt that Mrs. D was somewhat defensive about her son.

At the same time she expressed concern about having to live in the city.

CD was born during her menopausal years and had presented this mother most difficulty of all of her children because of his lack of resistence to illness. This coupled with the hearing problem necessitated his receiving more attention than any of the other children. As the youngest of a large household CD also got more attention from other members of the family while, at the same time, receiving less individual care while growing up. His needs were anticipated and were responded to and he used gestures with little or no verbal accompaniment.

The first four interviews dealt mainly with topics other than CD. His mother found it extremely difficult to talk about him, noting that he really didn't have any problems. Other than hoping there would be special education classes in their school district, she had no plans for CD's future. Since the boy could make himself understood among family members, she did not view his lack of speech as particularly handicapping. As a result, she worked very little, if at all, with him at home and indicated that he was much more interested in the activities going on around the house than in the follow-up homework.

It was not until the sixth interview that Mrs. D spoke of her son's ill health and his hearing problem. In the next interview the psychologist noted a deliberate attempt to avoid any talk of the child's language use. While there had been noticable progress in his use of verbal means both at home and in the nursery, his mother had been unable to work with him at home and continued to compare him with her other children. She felt that when he was enrolled in kindergarten she would be relieved. In this way the school could teach him what he must know and she need not feel guilty about working with him at home.

It was not until the final interview that CD's mother vented some of her anger towards the child. She stated that he made it difficult for her since he could not be treated the same as the others; she knew that she must talk to him but she frequently forgot to do so. She felt that CD should have been receiving therapy much sooner than had been the case but for one reason or another this had not been possible. It was the psychologist's impression that CD had not been realistically accepted as a child with a hearing loss who could be taught. Coming at the end of a long line of healthy children, and being completed unexpected (mother was four months pregnant before she knew it), it is understandable that he should be overprotected and simultaneously resented. The mother's rather fatalistic philosophy of doing the best she could in a way that removed responsibility from the parents as well as from the boy was felt, by the psychologist, to almost negate the acceptance of a problem that could be helped.

Upon being terminated from the nursery program, this boy was enrolled in a special education class in a metropolitan school district. At last report, his progress was satisfactory but not remarkable.

In the opinion of the clinical staff, a number of factors serve to minimize the effectiveness of this particular approach with this child. The fact that the family was located in an isolated area of the State prohibited his being enrolled in a remedial program as early as mightotherwise been the case. The anxiety and frustration felt by the mother was not sufficient to enable her to work satisfactorily with the child at home, thereby minimizing the effectiveness of whatever help he was receiving in the nursery school. This was further compounded by the child's frequent absences during the winter months due to colds, childhood diseases, etc. Audiometrically, this child would otherwise have been expected to show much more substantial gains in language and speech than was the case.

Subject DE: De was first seen at thirty-two months of age having been referred from the medical center where the diagnosis of severe hearing loss had been determined. DE had two older sisters and at the time of this interview his parents were in the middle of late twenties. The hearing loss was suspected when the boy was eighteen months of age because of his lack of response to auditory stimuli. The mother was the first person to suspect the loss and there is no family history of anyone else with hearing loss. The mother stated that during this pregnancy her health was excellent and reported no diseases or illnesses during this time. There were no medications taken during this pregnancy which was thirty-eight weeks in duration. The mother stated that labor with this child was less than one hour but that there were no injuries, anamolies, or debilitating conditions accompanying his birth. The mother and father are Rh compatable.

Insofar as motor skill development is concerned, DE sat alone unsupported at seven months, crawled at six months, took his first unassisted steps at twenty-six months. The delay in walking was attributed to the medical history, cited below. DE spoke his first meaningful word at nine months, his first short combination of words at ten months but had not yet spoken his first sentence. Because of his health problem, the adequacy of his speech had never been considered by the parents.

Bladder training had been initiated at ten months but had not been completed at the time of the initial interview; bowel training was initiated at ten months, also, and likewise was not complete.

DE experienced a recurring urinary tract infection around six weeks of age and suffered a severe attack of pneumonia at sixteen months; during this period he was treated with streptomicin. In addition, he had had the chicken pox and German measles. The boy had never suffered a severe accident and was not known to be allergic. He did have a history of very frequent middle ear infections, one episode of which continued to run from sixteen months (in conjunction with pneumonia) to twenty-three months when a myringotomy was performed. He never had discharge from the ear during infections, however, and neither tonsillectomy nor adenoidectomy had been performed.

Somewhat inconsistently, DE was reported to never face the speaker in order to understand. He responded only to television at full volume and trucks going by without his hearing aids on.

In the judgment of the interviewing clinician this child was considered to have attained the primary level of sound development but not the vocal or symbolic level; there was some question regarding the latter level of development.

DE had worn his hearing aids thirty months at the time the terminal data, below, were obtained.

By any set of criteria, this child would have to be deemed an outstanding failure on the basis of the

Subject: DE
Age: 5.0 years
Length of amplification: 30 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	95 db @ 500	95 db @ 500 & 1000
Hearing measurable up to and including:	500 cps	1000 cps

Of 50 responses:
mean length of response: 1
number of 1-word responses: 1
mean of 5 longest responses: 1
number of different words: 1
structural complexity score: 0
mean structrual complexity (MSC): 0
number of agreed on responses: 1
number of agreed on words: 1
Of these agreed on words there are:
nouns: 1
pronouns: 0
verbs: 0
prepositions: 0
adjectives: 0
adverbs: 0
articles: 0
interjections, etc: 0
other: 0

Templin-Darley score: No response on screening test

Peabody: Form A NR Form B ___
Ammons: Form A NR Form B ___

I.Q. score: 123 test: Merrill-Palmer
score: 97 test: W.I.S.C.
score: Incomplete test: Leiter

Vineland score: S.Q. 120; S.A. 6.0

Socioeconomic classification: V

foregoing test scores. Even considering the severe hearing loss which would classify him as "profoundly deaf" by many standards, for the length of time he had been in training more satisfactory language development should have resulted. One difficulty with these data might be inferred from the report of the psychologist at the time the I.Q. and Vineland scores were obtained:

"He resorts a great deal to facial expressions in whole body language to make his needs known. Occasionally, he mouths the words without speech; other times he says words or short sentences. During the testing session, DE exhibited no language whatsoever, although this examiner has known him through the nursery for over a year. He went eagerly to the testing room and soberly awaited instructions. The Lieter was introduced with items at the four year level. DE worked two subtests and then lost interest and started for the door. Efforts to interest him resulted in another subtest accurately performed followed by complete refusal to go further. He was again brought back to the testing room (as he headed down the hall) and quickly introduced to the Merrill-Palmer scale, which was completed in its entirety."

DE's mother was seen a total of 15 times during his initial year in the nursery school and once jointly with her husband. Mrs. E delved into her own feelings during these sessions particularly in regard to herself and her relationship with her husband's family members. She appeared to need a great deal of support, being essentially alone in a battle of attempting to maintain privacy for her family while her husband, still very much influenced by his mother, felt his wife to be weak, lenient, negligent, and lazy. These feelings were as his wife saw them and appeared to be erratic in nature.

DE appeared, to the psychologist, to be, for the most part, a pouty, angry, determined little boy. He gestered frequently and used to best advantage his highly expressive face. His language was very limited and behavior was rather enigmatic and erratic and quite unpredictable. Mrs. E's dealings with his behavior were complicated by her problems with two older children plus her own feelings of inadequacy in general. DE brought out the best in her by managing to test the limits frequently. Mrs. E alternated between recognizing this and dealing with it firmly and feeling guilt dealing with him leniently.

The first several interviews dealt with symptomatic treatment of attempting to alleviate some of the confusion and undue stress Mrs. E felt with regard to the boy and his sisters. Gradually, then, Mrs. E. brought up the problems of the household and her feelings regarding the child's problem. Throughout the entire series of interviews, the recurrent theme was one of tension in the home, guilt feelings on the part of the mother, and inconsistency in working with the child at home as well as in such areas as discipline. etc.

The psychologist felt that Mrs. E was a most interesting and challenging person with whom to work. She seemed to respond well to the support she received and seemed to need a great deal of this along with information on how to deal with her children and others. Basically, rather dependent, and feeling quite alone, she was having great difficulty dealing with her children. The lack of support from her husband and in-laws left her with the burden of responsibility, she felt. At the conclusion of the sessions, it was felt that she had gained some insight into her behavior and relationships so that her son's inconsistent and difficult behavior did not reduce her to tears and indecision as easily as it had previously. The psychologist felt that it was obvious that home speech reinforcement was sporadic because of DE's extreme behavior much of the time and the mother's inability to deal with it.

In the judgment of the clinical staff, DE's failure to profit in speech and language development during the course of his enrollment in the nursery school was primarily related to several factors. There is no question that his hearing loss was severe enough to minimize the extent of learning possible through audition alone. At the same time, as noted above, he did develop language which he used frequently without voice but which he refused to use in any test situation. The extreme tension felt in this child's home, coupled with the lack of reinforcement in the home, were also felt to be significant contributors to his lack of satisfactory development.

After termination from the nursery school program, DE was enrolled in a special education class of the public school system.

Subject EF: EF was first seen in the clinic at thirty-eight months of age having previously been found to have a severe bilateral hearing loss at the medical center. His parents were both in their thirties and he had four older brothers and sisters. The hearing loss was first suspected at thirty-two months of age by the family pediatrician who became alarmed at EF's lack of speech development. This was one of the few children for whom a parent was not the initial person to be concerned over the possibility of hearing loss. In this child's case, this nonchalance on the part of the parents was indicative of attitudes seen throughout the child's enrollment in the nursery school. There is no one else in the family with any history of hearing loss and there is no indication in the mother's health and medical history during pregnancy to indicate a prenatal disease or drug factor to be accountable. The pregnancy was reported to be of forty weeks duration with a labor of twelve hours; the birth was reported to have been normal in every respect with no difficulties noted. The parents are reported to be Rh incompatible.

Insofar as motor development is concerned, EF sat alone unsupported at twelve months, crawled at twelve months, and took his first unassisted steps at eighteen months. He had not yet spoken his first meaningful word nor any short combinations of words or sentences. The parents expressed concern over the child's inadequacy of speech. Neither bowel or bladder training had been initiated at this time. The child was remarkedly free of any childhood illnesses with none reported; neither had any childhood accidents been noted and the child was not felt to be allergic. The mother reported that he never suffered middle ear infections, had neither tonsillectomy or adenoidectomy or any other surgery, and had never been given drugs.

EF was reported to have to face the speaker occasionally in order to understand and was only aware of loud sounds without his hearing aid. In the judgment of the evaluating clinician, this child had reached none of the levels of sound and speech development under consideration.

At the time the terminal data were collected, EF had worn his hearing aid a total of eighteen months, and had been enrolled in the training program for twenty-two months. The discrepancy between length of amplification and length of training was accounted for by the father's reluctance to purchase the recommended hearing aid until some four months had passed and the clinical director had indicated the child would be terminated if the aid was not provided. The data reported are typical of this child's responses throughout his nursery school career.

Repeated attempts at counseling the parents separately and together met with failure. Assurances that work would be continued in the home with this child were never carried out. This is the only child enrolled in the program for whom the clinical staff had to check the functioning of the hearing aid; early in his career in nursery school it was discovered that EF frequently arrived with the aid not functioning, many times simply because the batteries had worn out.

Audiometrically, this child showed the potential for being a success in the approach under consideration. A combination of rather obvious factors were felt by the clinical staff to have negated this potential: the relative lateness with which the hearing loss was discovered, the hesitation on the part of the parents to do anything about this, and the lack of parental cooperation to reinforce the work being conducted in the nursery school are likely contributors toward this failure. This child was retained in the program solely on the basis of his audiometric findings in order to establish whether, with sufficient stimulation during nursery school, he could have profited from this approach utilizing his hearing residual. Obviously, this was not the case.

At last report, the parents had alienated the principal of the special education school and were apparently considering sending the child to the State School for the Deaf, a prospect which pleased the mother since she felt she would no longer have to be responsible for his training.

Subject: EF
Age: 5 years, 3 months
Length of amplifcation: 18 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	78 db	83 db
Hearing measurable up to and including:	4000 cps	4000 cps

No intelligible responses

Templin-Darley score: Could not evaluate on screening test

Peabody: Form A M.A. 1-11
Ammons: Form A C.A. 4-11

I.Q. score: 82 test: Leiter

Vineland score: S.Q. 107, S.A. 5.6

Socioeconomic classification: II

Subject FG: FG was first seen in a clinic at four years of age; her parents were both in their mid-twenties and had one other child at this time. The child was referred by a local otologist for diagnosis and therapy with the referring complaint being a hearing loss, probably congenital, which had first been suspected by the father when the child was twelve months of age. The reason for the hearing loss being suspected was the lack of response by the child to auditory stimuli. The parents felt the loss was gradually becoming worse and reported that a maternal grandmother and maternal great-grandfather both were said to have had hearing losses. The general health during prenancy was stated to be fair with no diseases during this time and no medications taken. Pregnancy was approximately thirty-eight weeks in duration with a labor of thirteen hours; the mother reported instruments being used during the delivery with moderate birth injury to the left cheek which was still visible until the child was two years of age. The mother was unsure of any other conditions present at birth; the parents were reported to be Rh compatible. Insofar as motor development is concerned, FG sat alone at four months, crawled at six months, took her first unassisted steps at nine months, and spoke her first meaningful word at fourteen months. The parents were unsure as to when she spoke her first short combination of words but reported her first sentences at forty months. The parents expressed concern over the child's inadequacy of speech. Bladder training was initiated at twenty-four months and reported to have been completed at thirty months' bowel training was reported initiated at seven months and was reported completed at eighteen months. The only childhood disease reported was measles at forty-nine months of age and the child had no severe accidents and was reported not to be allergic. No middle ear infections at any time were reported and the child had had both tonsilectomy and adenoidectomy but no other surgery. The only drugs taken by the child were short term therapy with oral terramycin.

FG was reported to very often to face the speaker in order to understand and showed erratic response to doorbell and telephone with amplification. In the opinion of the evaluating clinician, this child had achieved the primary,vocal, symbolic, and oral levels of sound and language development.

FG is shown as having amplification for eleven months at the time the terminal data, below were obtained; in actuality, she had been in training using a hearing aid on loan for some twenty-one months by this time.

FG shows a number of factors which should lead to exceptional speech and language development. For example, the hearing in her right ear, while handicapping, shows good residual through 8,000 cycles and would be considered moderate in extent. In addition, from the history given and the audiometric data obtained, it is likely that this terminal audiogram represents some progression over a period of time. From the linguistic data presented on the following page, it can be inferred that FG's articulation presented more of a problem than other dimensions of language development as indicated by the Templin-Darley score. Her articulation was not sufficiently poor, however, to substantially lower the number of agreed on responses reported. With the exception of prepositions, this child showed

Subject: FG
Age: 5.0 years
Length of amplifcation: 11 months
Aid: binaural _____ or monaural X

Hearing (pure tone average):		
if only one or two frequencies	right	left
measurable, specify which	58 db	83 db
Hearing measurable up to and including:	8000 cps	2000 cps

Of 50 responses:
mean length of response: 2.39
number of 1-word responses: 13
mean of 5 longest responses: 5.2
number of different words: 23
structural complexity score: 8
mean structural complexity (MSC): .28
number of agreed on responses: 28
number of agreed on words: 67
Of these agreed on words there are:
nouns: 25
pronouns: 9
verbs: 11
prepositions: 0
adjectives: 8
adverbs: 1
articles: 10
interjections, etc: 3
other: ___

Templin-Darley score: 7 on screening test

Peabody: Form A 96 Form B
Ammons: Form A 7.5 Form B

I.Q. score: 159 test: Leiter
score: 102 test: Stanford-Binet

Vineland score: 161

Socioeconomic classification: VI

knowledge of all parts of speech and the structural complexity score indicates a relatively high level of linguistic sophistication. Reviewed as measures of mental age, the Peabody and Ammons tests show some discrepancy with the Ammons score being more closely related to the standard I.Q. measures. The Leiter scale score would place this child in the highly superior range; for this reason, the Stanford-Binet was used as a secondary test even though it is primarily a verbal measure. FG is noted to perform at the average range on this test. The Vineland score is consistent with the Leiter and Ammons scores.

On termination from the nursery school program, FG was enrolled in regular public school. Due to her articulation problem, however, more intensive speech therapy was felt to be desirable and she was subsequently transferred to a special education class. At last report, FG was doing very well academically and no furthering of the hearing loss was known to have occurred although subsequent to her dismissal from the nursery program a more powerful hearing aid was recommended for her.

Subject GH: This boy was first seen at the Hearing Center at three years of age. The primary informant was the child's stepmother, therefore portions of these data regarding early history are somewhat vague. At the time of the initial interview the father was 29 years of age, the stepmother 23 years of age. The family had been referred to the Hearing Center by a school official for therapy and GH had already had an initial hearing assessment and been fitted with a hearing aid. The referring complaint was the confirmed hearing loss and its resultant speech retardation.

The onset of the problem was felt to have been congenital and GH was first suspected of having a hearing loss by his grandmother at 18 months when she noted that he did not startle in response to loud sounds. GH has two sisters but no one else in the family was known to have any hearing loss. There had been no change in the hearing loss noticed by any member of the family up to this time. So far as is known, the child's mother was in excellent health during this pregnancy and had no diseases nor had been administered any medication during this pregnancy

Approximate length of pregnancy was 40 weeks, length of labor was unknown as were most details surrounding this child's birth. Birth weight, conditions at birth, etc., were unknown but the child's parents were known to be Rh compatible. It was not known when GH first sat alone without support nor when he first crawled; he was reported to have taken his first unassisted steps at nine months but was not known when he first spoke a meaningful word. The stepmother felt the boy first spoke a short combination of words at 26 months and his first sentence at 36 months; both parents expressed concern over his speech adequacy.

It was not known when bladder training was initiated but was reported to have been completed by 18 months as was bowel training.

GH was reported to have had measles and tonsillitis prior to the time of this interview but no relationship between the child's diseases, his subsequent drug history, and loss of hearing were noted. GH was reported to have no allergies and very rarely had ear infections or discharge from the ear during infection. The only drug known to have been administered to GH was streptomycin but, since the time and dosage were not known, no relationship between drug and hearing loss could be ascertained.

GH was reported to occasionally face the speaker in order to understand what was being said and was reported to be able to respond to whispered voice behind his back, his parents voices in another room of the house, both the doorbell and telephone, and airplanes flying overhead. In the judgment of the interviewing clinician GH had achieved primary, vocal, symbolic, and oral levels of language development. Previous hearing tests, coupled with subsequent ones administered during his enrollment in the program, indicates some variability in hearing test response. No medical diagnosis of the cause of hearing problem had been made at this time.

The terminal data obtained from this boy, summarized on Page 114, reveal little significant information. The articulation test indicates rather severe articulatory difficulties but insofar as total verbal output is concerned, this child was performing relatively well at the time. The greatest discrepancy in test scores is

Subject: GH
Age: 5.0 years
Length of amplification: 22 months
Aid: binaural ____ or monaural X
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	83 db	68 db
Hearing measurable up to and including:	8000 cps	4000 cps

Of 50 responses:
mean length of response: 1.84
number of 1-word responses: 15
mean of 5 longest responses: 3.6
number of different words: 32
structural complexity score: 1.0
mean structural complexity (MSC): .04
number of agreed on responses 26
number of agreed on words: 45
Of these agreed on words there are:
nouns: 33
pronouns: 1
verbs: 4
prepositions: 0
adjectives: 0
adverbs: 1
articles: 5
interjections, etc.: 0
other: 0

Templin-Darley score: 5 on screening test

Peabody: Form A _____ Form B 3.9
Ammons: Form A 7.5 Form B _____

I.Q. score: 105 test: Stanford-Binet
score: 110 test: Leiter

Vineland score: 104

Socioeconomic classification: III

seen in comparison of the vocabulary and I.Q. scores. As noted in other cases, marked inconsistency can be seen in a comparison of the Peabody with the Ammons' score; most outstanding in light of the undistinguished language score, is the I.Q. obtained on the Stanford-Binet. This test correlates remarkably well with the Vineland score and is within the same general range as the Leiter.

At last report, GH was enrolled in a special class for hard of hearing in the public school and was making satisfactory academic progress.

Subject HI: HI was first suspected of having a hearing loss at 24 months of age; for a variety of reasons, however, he was not referred for audiometric testing until two years later. At the time of the initial interview, HI's mother was 40 years of age, his father 36 years of age; the mother was primary informant.

HI was referred to the hearing center by the family pediatrician for diagnosis with primary referring complaint being speech retardation; strong suspicion existed that HI was mentally retarded but the mother's previous concern over hearing loss resulted in the desire for an audiometric assessment. The onset of the problem was prior to the development of first words and was first suspected by a family physician, not the pediatrician referred to on page 115. There is no history of any one else in the family with a hearing loss.

HI is the only boy in the family; he has four sisters. The mother's health during this pregnancy was excellent and there were no diseases noted and no medications taken during the pregnancy. The mother had never suffered from a miscarriage and pregnancy was of 34 weeks duration with a precipitous birth after labor of less than one hour. Delivery was head presentation with severe cranial birth injury noted resulting in what the medical report termed "peripheral nerve palsy" with both cyanosis and anoxia also noted at birth to such an extent that the attending physician gave the mother no hope of the child's survival.

Parents are Rh compatible and, birth difficulties notwithstanding, HI sat alone without support at eight months, crawled by six months, and took his first unassisted steps at 15 months after one leg had been braced.

It was not known when this boy first spoke a meaningful word, but in the opinion of the parents his first short combination of words came at 33 months with first sentences by 43 months. As might be expected, concern was expressed over his inadequacy of speech.

Both bladder and bowel training had been completed by 36 months with the mother not being sure of the exact time when toilet training was initiated. No severe childhoold diseases were reported other than chicken pox and HI had suffered no serious accidents. Drug history was uncertain and unclear with the notation that "maybe" streptomycin had been given at birth.

HI was reported to never face a speaker in order to understand when being spoken to and responded to such sounds as the telephone, airplane, parents voices in another room, and dog barking outside the house. In the opinion of the interviewing clinician, HI had obtained primary, vocal, symbolic, and oral levels of language development.

HI had had no previous hearing tests and no medical diagnosis had been made to account for his hearing problem. The mother was of the opinion that the combination of oxygen deprivation at birth, birth injury, and, possibly, drug treatment given at birth were all responsible to some extent.

The terminal data reported on page 120 are interesting in several respects. HI's mean length of response is quite good considering the extent of hearing loss and relatively short period of time under amplification. Better than one-half of his responses were of more than one word in length and the total number agreed on words is similarly high. Of the number of agreed on words, a rather atypical pattern of usage is noted with both pronouns and verbs used in greater amount than nouns and with all parts of speech being represented. The Templin-Darley score of 23 is a further reflection of this boy's progress; a marked discrepancy is again noted between the Peabody and Ammons vocabulary scores; remarkably good correlation is noted among the Stanford-Binet, Leiter, and Vineland scores.

After successfully completing the first grade in a totally hearing classroom, this child was transferred to a part-time special education class for hearing impaired children on the request of the second grade teacher who felt that she was unable to cope with the child who wore a hearing aid in her class. At last report, HI was progressing very satisfactorily in school and was taking most of his class work with totally hearing children.

Subject IJ: IJ was 39 months old when his mother first suspected a hearing loss. At this time his father was 29 years of age, the mother was 27 years of age. The reason a hearing loss was suspected was speech retardation and the first person to relate the lack of speech development to hearing loss was the Hearing Center audiologist. The child was brought to the Center by his mother, a self-referral, for diagnosis of the problem. IJ had one younger brother at this time and there was no history of anyone else in the family with hearing loss.

The mother reported her health during this pregnancy to be excellent with no known diseases having occurred during this time and no known toxic drug being administered during this pregnancy. The mother reported the pregnancy to be of 38 weeks duration with a period of labor lasting 13 hours.

Subject: HI
Age: 5.0
Length of amplification 15 months
Aid: binaural ___ or monaural X
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	73 db	70 db
Hearing measurable up to and including:	8000 cps	4000 cps

Of 50 responses:
mean length of response: 2.05
number of 1-word responses: 19
mean of 5 longest responses: 4.8
number of different words: 39
structural complexity score: 7
mean structural complexity (MSC): .18
number of agreed on responses: 39
number of agreed on words: 80
Of these agreed on words there are:
nouns: 12
pronouns: 28
verbs: 20
prepositions: 3
adjectives: 1
adverbs: 9
articles: 2
interjections, etc.: 5
other: 0

Templin-Darley score: 23 on screening test

Peabody: Form A ____ Form B 4.6
Ammons: Form A 5.5 Form B ____

I.Q. score: 93 test: Stanford-Binet
score: 90 test: Leiter

Vineland score: 90

Socioeconomic classification: III

Delivery was head first with no instruments being used and no birth injury being incurred. There were no debilitating conditions present at birth; the parents are Rh compatible. IJ weighed 118 ounces at birth.

Insofar as motor development is concerned, IJ sat alone unsupported at five months, crawled at seven months, took his first unassisted steps at eleven months, spoke his first meaningful word at twelve months, and was judged to have spoken his first short combination of words by twenty-four months. At the time of the initial interview, he had not yet spoken a meaningful sentence. The child's speech was a cause for concern by the parents and was, as noted above, the primary reason for referral to the Center.

Bladder training was initiated at 21 months and was reported to have been completed at 22 months; bowel training was initiated simultaneously and was also reported to have been completed by 22 months.

With the exception of chicken pox, IJ was reported to have suffered no severe childhood disease. He had never had a severe accident but was known to have a seasonal upper repiratory allergy. Middle ear infections and discharge from the ear were reported as occurring only rarely.

IJ had had neither tonsillectomy nor adnoidectomy or any other surgery and the only drug known to be administered during his history was acromycin, dosage and length of administration unknown.

IJ was reported to very often have to face the speaker in order to understand and responded only to such sounds as doorbell and telephone, and planes flying overhead, automobile noises, and television.

In the judgment of the interviewing clinician, IJ had reached the primary, vocal, and symbolic levels of language development but it was not sure whether he had yet attained the oral level. No previous hearing tests had been administered and no medical diagnosis had been made of the problem.

The terminal data for IJ, below, stand out in marked contrast to those of the previous subject. It can readily be determined, for example, that while his mean length of response was nearly two and one-half words and the mean of his five longest responses nearly six words, the total vocal output per response consisted primarily of naming objects in the stimulus materials. This can be further determined by the observation that there are only 23 different words used in a total of 50 agreed on responses resulting in a total number of agreed on words of 123; this indicates each word was used, on the average, nearly five times. IJ's Templin-Darley score of 31 is probably satisfactory considering the extent of his hearing loss and the relative short time he had been under amplification. As noted in previous subjects, there is a marked discrepancy on the vocabulary test scores with nearly three years difference between Form A of the Ammons compared with Form A of the Peabody and better than a one year difference between Form A and Form B of the Ammons test. As might be expected, on the basis of the foregoing, IJ scores lower on the primarily verbal Stanford-Binet test while his scores for the Leiter and Vineland show close similarity.

This child was the only one in the entire sample whose parents were both professional people (school teachers) and yet was one of the few in whom a loss of hearing was not suspected even though he had passed his third birthday and was markedly retarded in speech

Subject: IJ
Age: 5 years, 1 month
Length of amplification: 17 months
Aid: ninaural ______ or monaural X
Hearing (pure tone average);

	right	left
if only one or two frequencies measurable, specify which	73 db	70 db
Hearing measurable up to and including:	8000 cps	8000 cps

Of 50 responses:
- mean length of responses: 2.4
- number of 1-word responses: 16
- mean of 5 longest responses: 5.8
- number of different words: 23
- structural complexity score: 0
- mean structural complexity (MSC): 0
- number of agreed on responses: 50
- number of agreed on words: 123
  - Of these agreed on words there are:
    - nouns: 61
    - pronouns: 59
    - verbs: 0
    - prepositions: 0
    - adjectives: 2
    - adverbs: 0
    - articles: 0
    - interjections, etc.: 1
    - other: 0

Templin-Darley score: 31 on screening test

Peabody: Form A 2.4 Form B _____
Ammons: Form A 5.3 Form B 4.1

I.Q. score: 79 test: Stanford-Binet
score: 107 test: Leiter

Vineland score: 114

Socioeconomic classification: I

development. At last reports, this boy was attending a totally hearing class and was receiving supplementary help in speech correction and language development; his academic progress was satisfactory although not exceptional.

Subject JK: JK was first seen at the hearing center at the age of 34 months, having been referred by an otologist who had confirmed the presence of the hearing loss. At the time of referral, her father was 29 years of age and her mother 28 years. Her mother, who was the primary informant, reported that she herself first suspected the hearing loss when the child was eight months old because of the child's lack of vocal output, lack of startle response, and lack of awareness to auditory stimuli. The loss was felt to be congenital and had not been felt to have changed since first noticed. JK had two brothers at the time of her initial interview and no one in the family was known to have a hearing loss.

The mother reported that, she had rubella the first five weeks of pregnancy, but in all other respects her health during this pregnancy was excellent; mother had no medications administered during this pregnancy and had never previously suffered from a miscarriage. The pregnancy was estimated to have been 40 weeks in duration with the length of labor of three hours. Labor was not induced and delivery was head presentation with no instruments being used and no cranial birth injury reported. There are no congenital anomilies noted and no debilitating conditions present at birth; the parents are Rh compatible.

JK weighed 121 ounces at birth, sat alone unsupported at 8 months, crawled at 10 months, took her first unassisted steps and spoke her first meaningful word both at 17 months. At the time of the interview, she was not felt to have spoken first short combinations of words, this being reported later at 39 months with sentences coming after the initiation of amplification at 42 months. As might be expected, the parents were concerned over the child's inadequacy in speech. Bladder training was initiated at 30 months as was bowel training; bladder training was completed at 42 months and bowel training was completed by 36 months.

JK had had chicken pox, measles, and mumps at the time of this interview; she had no history of allergy and had never suffered a severe accident. JK was reported to only very rarely have middle ear infections and had never had a dischrage from the ears. She had never had surgery. The only drug history was streptomicin administered when she was three years old; amount of drug dosage was not known, but any effect would have been in addition to the pre-existing known hearing involvement.

JK was reported to very often face the speaker in order to understand and responded only to such loud sounds as barking dogs, airplanes, and occasional voices behind her back. In the judgment of the interviewing clinician, JK had received primary, vocal, symbolic, and oral levels of language development. Previous hearing tests were confirmed at the center at this time and subsequently during this child's enrollment in the clinical program.

The terminal data reported on the following page are indicative of the measures of speech and language development possible when a child has a moderate amount of residual hearing, coupled with a cooperative

Subject: JK
Age: 5.0
Length of amplification: 23 months
Aid: binaural ____ or monaural X
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	65 db	73 db
Hearing measurable up to and including:	8000 cps	4000 cps

Of 50 responses:
mean length of response: 2.2
number of 1-word responses: 22
mean of 5 longest responses: 5
number of different words: 62
structural complexity score: 10
mean structural complexity (MSC): .2
number of agreed on responses: 50
number of agreed on words: 110
Of these agreed on words there are:
nouns: 55
pronouns: 11
verbs: 30
prepositions: 0
adjectives: 3
adverbs: 3
articles: 4
interjections, etc.: 2
other: 0

Templin-Darley score: 47 on screening test

Peabody: Form A 3.6 Form B 4.6
Ammons: Form A 6.5 Form B 5

I.Q. score: 91 test: Stanford-Binet
score: 130 test: Leiter

Vineland score: 118

Socioeconomic classification: I

family background and intensive and varied auditory stimulation. JK was an extremely shy child throughout her enrollment in the program, but the language results indicate a rather sophisticated level of language development. While her mean length of response was rather small and a reflection of the fact that nearly half her responses were of one word, the mean of her longest responses of five words is an indication of the extent of speech she was capable of producing.

That such responses were not typical was indicated by the parts of speech used. In addition to the remarkably high Templin-Darley score of 47, this child's intelligibility can be inferred from the fact that there were 110 agreed on words over 50 responses with a mean length of response of 2.2 words indicating near-total intelligibility. At the same time, this level of speech proficiency is not reflected in either Form A or Form B of the Peabody scores or the Ammons scores. Nearly one and one-half years difference were found between comparable forms of the Ammons test and a one year difference in comparable forms of the Peabody. The greatest discrepancy, however, is noted in comparing the Stanford-Binet with the Leiter results; in this case, the Vineland score seems to approximate middle ground.

On the basis of this child's academic achievement in totally hearing classroom, it would appear that the Vineland score might be the best indication of her level of academic functioning in that she has achieved above average scores throughout her academic work to date. (The socio-economic classification in this instance is somewhat misleading in that the father was a graduate student during most of the time the child was enrolled in the clinical program.)

Subject KL: KL was first seen at the Hearing Center at the age of 40 months; at this time her father was 35 years of age and her mother 31. KL was referred to the center by an otologist for diagnosis and therapy with a hearing loss being suspected but not confirmed. The onset of the problem was felt to be prior to the development of the child's first words and was suspected by the mother when KL was 18 months of age because she was slow in developing speech The mother felt that her child's hearing had gotten gradually better since this time but was unsure whether this was due to change in the hearing level or in the child's attentiveness. KL had one younger sister at this time and a rather marked family history of previous hearing loss with both maternal grandparents and one maternal uncle being deaf.

The mother reported that her health during this pregnancy was excellent with no diseases noted. There is no history of drug usage during this pregnancy. The mother had previously had one stillborn child. The approximate length of pregnancy was 40 weeks with length of labor reported to be five hours.

Delivery was head presentation with no cranial birth injury or congenital anomalies noted. There were no debilitating conditions present at birth and the parents are Rh compatible. KL's birth weight was 112 ounces.

KL first sat alone unsupported at six months, first crawled at six months, spoke her first meaningful word at 12 months, took her first unassisted steps at 13 months, and spoke her first combination of words at 24 months. At the time of this interview she had not yet spoken her first sentence and the parents were concerned over her inadequate speech.

Bladder and bowel training were both initiated at 24 months and completed at 30 months.

KL had had a severe ear infection at the age of six months with high fever being noted three days during this period of time; the only childhood disease reported by this time was measles. The child had not had any severe accidents and was not known to be allergic. Middle ear infections were reported to be a very rare occurrence with ear discharge never reported. The child had had neither tonsillectomy or adnoidectomy or any other surgery and the only drug administered was auromycin, dosage unknown.

KL was reported very often to have to face the speaker in order to understand when being spoken to and was reported to fully respond to such sounds as a plane flying overhead. In the judgment of the interviewing clinician, KL had attained all levels of language development at the time of this interview. There were no previous hearing tests administered and a medical diagnosis had not been made of the problem although it was suspected with considerable assurance that a genetic factor was largely responsible.

The terminal data reported on the following page resemble, in many respects, those reported for the previous subject. Mean length of response was slightly over 2 words with roughly 1/3 of the total responses being one word in length. The mean of the five longest responses was slightly more than 4 and one-half words and KL was noted to have used 55 different words over 50 agreed on responses with a total of 108 agreed on words for the entire sample. In common with the preceeding subject, she shows remarkedly good use of all parts of speech with verbs predominately followed by nouns and pronouns. The Templin-Darley score of 31 is considerably poorer than that reported for the previous child although the hearing levels are not markedly different. In common with previous subjects, a marked discrepancy is seen on the vocabulary test items; again, a one year discrepancy is noted between

Subject: KL
Age: 5.0 years
Length of amplification: 14 months
Aid: binaural ___ or monaural X
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	62 db	63 db
Hearing measurable up to and including:	4000 cps	4000 cps

Of 50 responses:
mean length of response: 2.16
number of 1 word responses: 16
mean of 5 longest responses: 4.6
number of different words: 55
structural complexity score: 7
mean structural complexity (MSC): .14
number of agreed on responses: 50
number of agreed on words: 108
Of these agreed on words there are:
nouns: 27
pronouns: 16
verbs: 34
prepositions: 1
adjectives: 16
adverbs: 1
articles: 8
interjections, etc.: 5
other: —

Templin-Darley score: 31 on screening test

Peabody: Form A 2.8 Form B ___
Ammons: Form A 6.5 Form B 5.5

I.Q. score: 98 test: Stanford-Binet
score: 151 test: Leiter

Vineland score: 136

Socioeconomic classification: II

Form A and Form B of the Ammons test. The IQ scores are most divergent of any child reported with KL responding at an average level on the Stanford-Binet but in the markedly superior range on the Leiter. The Vineland score of 136, again, represents somewhat of a middle ground and relates rather closely with the higher of the two Ammons scores.

At last report, this child was progressing satisfactorily in a totally hearing classroom, with only occasional sessions of supplementary speech therapy after class. While her academic record does not measure up to the Leiter score reported, she is definitely functioning at an above-average level academically.

Subject LM: LM was first seen at the Hearing Center at the age of 40 months. Her parents were both 28 years of age. This child was referred with a confirmed hearing loss by a university some distance away; initial testing had occurred prior to the father's transfer to Denver.

The mother reported that LM's hearing loss was felt to be prior to the development of first words in that the first person to suspect the hearing loss was a neighbor who noted that the child did not respond to auditory stimuli; LM was 33 months of age when the loss was first suspected and no change had been noted in her hearing since that time. LM had one older brother at this time and there was no one in the family with a history of hearing loss.

The mother reported that her health during this pregnancy was good. The mother had never suffered a stillbirth or a miscarriage.

The approximate length of this pregnancy was 40 weeks with labor reported as 13 hours. Delivery was head presentation with no instruments used and no cranial birth injury or other debilitating conditions noted at birth. The parents are Rh compatible.

LM weighed 142 ounces at birth, sat alone unsupported at six months, crawled at 11 months, took her first unassisted steps at 13 months, spoke her first meaningful word at 14 months, her first short combination of words at 33 months and was judged to have spoken a sentence by 37 months. Parents reported some concern over the child's inadequate speech.

Bladder and bowel training were initiated simultaneously at 24 months and reported to have been completed by 26 months.

LM had mumps at 34 months and recurring tonsilitis between one and one-half and two years. The only drug therapy known during this period of time was acromycin and penicillin, dosages unknown. The child had never had a severe accident, was not known to be allergic, but was very frequently reported to have had frequent ear infections one winter, during the time of the severe tonsilitis, but never had discharge from the ear during this time. The child had had neither tonsillectomy nor adenoidectomy or any other surgery.

LM was reported to have to face the speaker very often in order to understand and was observed to notice and be aware of loud sounds generally, including loud speech. In the judgment of the interviewing clinician, LM had obtained the primary, vocal, symbolic, and oral levels of language development. There was no clear cut etiology determined by the child's physicians to account for the hearing loss.

Analysis of the terminal data reported on the following page indicate, in common with the preceding two children, very satisfactory language development, particularly in view of the relatively short period of amplification. This is due, in part, to the moderate character of the child's hearing loss. This child is seen to have a large mean length of response, large mean of 5 longest responses, and large number of agreed on words. In addition to the remarkably high Templin-Darley score, her intelligibility can be inferred from the comparison of number of agreed on words with number of agreed on responses and mean length of response. Verbs predominate in her language sample with nouns and pronouns following. Neither the Peabody or Ammons vocabulary scores reflect the adequacy of her language as revealed on other measures; again, these scores are seen to be discrepant compared to the IQ scores which are, for all intents and purposes, identical. This factor gives further supporting evidence for the

Subject: LM
Age: 5.0 years
Length of amplification: 12 months
Aid: binaural ___ or monaural X

	right	left
Hearing (pure tone average): if only one or two frequencies measurable, spcify which	57 db	57 db
Hearing measurable up to and including:	8000 cps	8000 cps

Of 50 responses:

mean length of response:	3.4
number of 1 word responses:	10
mean of 5 longest responses:	7.2
number of different words:	71
structural complexity score:	15
mean structural complexity (MSC):	.3
number of agreed on responses:	50
number of agreed on words:	170

Of these agreed on words there are:

nouns:	41
pronouns:	27
verbs:	51
prepositions:	14
adjectives:	5
adverbs:	4
articles:	1
interjections, etc.:	10
other:	—

Templin-Darley score: 47 on screening test

Peabody: Form A 108-110 Form B 4.9
Ammons: Form A 110 Form B ___

I.Q. score: 108-110 test: W.I.S.C.
score: 110 test: Leiter

Vineland score: 135

Socioeconomic classification: II

adequacy of this child's linguistic functioning. Again, the Vineland score is markedly higher than any other test scores.

Length of time this child was under amplification is somewhat misleading since the initial five months of her hearing aid use was very erratic due to technical difficulties with the instrument; accordingly, only the time the child was with continual usage of hearing aids is the length of time with amplification calculated.

At last report, this child was continuing to make very satisfactory progress in a totally hearing classroom. During her initial year in elementary school, she was receiving some supplementary speech therapy.

Cleveland Group

Data were obtained on 26 children meeting the criteria previously outlined for inclusion in the study. Of this number, 10 were later found to not have been appropriate for one of a variety of reasons such as multiple handicap, insufficient loss of hearing, etc.

In view of the limited numbers of children available in either group, the initially hoped-for matching was not achieved; an additional factor, not anticipated initially, would further have compounded this difficulty. This factor was the lack of prior exposure to the clinician obtaining the terminal data and lack of prior experience in similar test situations. In addition, it was extremely difficult to locate a number of the children and make arrangements for them to be tested within one month of the fifth birthday. In many cases, it was necessary to bring the child in some months after this time had passed so that any bias existing in the sampling procedure would tend to favor the Cleveland group on the age variable.

The following summaries are presented for purposes of overall comparison rather than as being indicative of a matched subject procedure. Six of the subjects reported gave no intelligible verbal responses. As might be expected, all six have severe hearing losses and even though each had been using binaural amplification for a number of months it would appear the child had not yet been able to utilize monitoring his own speech through the auditory sense.

Subject: XA

Age: 72 months

Length of amplification: 54 months

Aid: binaural X or monaural ___

Hearing (pure tone average):	right	left
if only one or two frequencies measurable, specify which	90 (500 only)	90 (500 only)
Hearing measurable up to and including:	500 cps	500 cps

Templin-Darley score: 15 on screening test

Peabody: Form A MA: 3-1 Form B ________

Ammons: Form A ________ Form B ________

I.Q. score: 115 test: Merrill-Palmer

Socioeconomic classification: III

Subject: XB
Age: 60 months
Length of amplification: 30 months
Aid: binaural X or monaural ___

	right	left
Hearing (pure tone average): if only one or two frequencies measurable, specify which	87 db	97 db
Hearing measurable up to and including:	1000 cps	1000 cps

Templin-Darley score: 14 on screening test

Peabody: Form A __________ Form B MA: 1-11

Socioeconomic classification: III

Subject: XC
Age: 62 months
Length of amplification: 27 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	95 db	90 db
Hearing measurable up to and including:	1000 cps	1000 cps

Templin-Darley score: 18 on screening test

Peabody: Form A _________ Form B MA: 1-11

Socioeconomic classification: V

Subject: XD
Age: 72 months
Length of amplification: 48 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	72 db	77 db
Hearing measurable up to and including:	1000 cps	1000 cps

Templin-Darley score: 22 on screening test

Peabody: Form A MA: 2-1 Form B ________

Socioeconomic classification: Not classifiable

Subject: XE
Age: 72 months
Length of amplification: 32 months
Aid: binaural ___ or monaural X
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable specify which	60 db	70 db
Hearing measurable up to and including:	2000 cps	2000 cps

Of 50 responses:
mean length of response: 1.16
number of 1 word responses: 5
mean of 5 longest responses: 1.2
number of different words: 4
structural complexity score: 0
mean structural complexity (MSC): -
number of agreed on responses: 6
number of agreed on words: 7
of these agreed on words there are:
nouns: 0
pronouns: 0
verbs: 0
prepositions: 0
adjectives: 0
adverbs: 0
articles: 0
interjections, etc.: 1
other: 0

Templin-Darley score: 9 on screening test

Peabody: Form A MA: 1-11 Form B ________

Socioeconomic classification: V

Subject: XF
Age: 58 months
Length of amplification: 29 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	43 db	67 db
Hearing measurable up to and including:	2000 cps	2000 cps

Of 50 responses:
mean length of response: 1
number of 1 word responses: 10
mean of 5 longest responses: 1
number of different words: 5
structural complexity score: 0
mean structural complexity (MSC) -
number of agreed on responses: 10
number of agreed on words: 10
of these agreed on words there are:
nouns: 10
pronouns: 0
verbs: 0
prepositions: 0
adjectives: 0
adverbs: 0
articles: 0
interjections, etc.: 0
other: 0

Templin-Darley score: 30 on screening test

Peabody: Form A MA: 2-2 Form B ________

Socioeconomic classification: III

Subject: XG
Age: 59 months
Length of amplification: 29 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	60 db	65 db
Hearing measurable up to and including:	2000 cps	2000 cps

Of 50 responses:
mean length of response: 1
number of 1 word responses: 17
mean of 5 longest responses: 1
number of different words: 8
structural complexity score: 0
mean structural complexity (MSC): -
number of agreed on responses: 17
number of agreed on words: 17
of these agreed on words there are:
nouns: 17
pronouns: 0
verbs: 0
prepositions: 0
adjectives: 0
adverbs: 0
articles: 0
interjections, etc.: 0
other: 0

Templin-Darley score: 12 on screening test

Peabody: Form A MA: 2-5 Form B ________

Socioeconomic classification: III

Subject: XH
Age: 72 months
Length of amplification: 55 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	88 db	100 db
Hearing measurable up to and including:	2000 cps	2000 cps

Of 50 responses:

mean length of response:	1
number of 1 word responses:	2
mean of 5 longest responses:	-
number of different words:	2
structural complexity score:	0
mean structural complexity (MSC):	-
number of agreed on responses:	2
number of agreed on words:	2
of these agreed on words there are:	
nouns:	1
pronouns:	0
verbs:	0
prepositions:	0
adjectives:	1
adverbs:	0
articles:	0
interjections etc.:	0
other:	0

Templin-Darley score: 19 on screening test

Peabody: Form A MA: 2-5 Form B ________

Socioeconomic classification: II

Subject: XI
Age: 72 months
Length of amplification: 38 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	85 db	87 db
Hearing measurable up to and including:	2000 cps	2000 cps

Of 50 responses:
mean length of response: 1.2
number of 1 word responses: 8
mean of 5 longest responses: 1.4
number of different words: 2
structural complexity score: 0
mean structural complexity (MSC): -
number of agreed on responses: 10
number of agreed on words: 12
of these agreed on words there are:
nouns: 11
pronouns: 0
verbs: 0
prepositions: 0
adjectives: 0
adverbs: 0
articles: 0
interjections, etc.: 1
other: 0

Templin-Darley score: 16 on screening test

Peabody: Form A MA: 2-3 Form B ________

Socioeconomic classification: II

Subject: XJ
Age: 72 months
Length of amplification: 33 months
Aid: binaural ___ or monaural X
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	47 db	63 db
Having measurable up to and including:	2000 cps	2000 cps

Of 50 responses:
mean length of response: 1.37
number of 1 word responses: 11
mean of 5 longest responses: 2.4
number of different words: 18
structural complexity score: 1
mean structural complexity (MSC): .06
number of agreed on responses: 16
number of agreed on words: 23
of these agreed on words there are:
nouns: 10
pronouns: 1
verbs: 10
prepositions: 0
adjectives: 1
adverbs: 1
articles: 0
interjections, etc.: 0
other: 0

Templin-Darley score: 28 on screening test

Peabody: Form A MA: 2-4 Form B ________

Socioeconomic classification: III

Subject: XK
Age: 72 months
Length of amplification: 48 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	95 db	95 db
Hearing measurable up to and including:	2000 cps	2000 cps

Of 50 responses:
mean length of response: 1
number of 1 word responses: 2
mean of 5 longest responses: -
number of different words: 1
structural complexity score: 0
mean structural complexity (MSC): -
number of agreed on responses: 2
number of agreed on words: 2
of these agreed on words there are:
nouns: 2
pronouns: 0
verbs: 0
prepositions: 0
adjectives: 0
adverbs: 0
articles: 0
interjections, etc.: 0
other: 0

Templin-Darley score: 7 on screening test

Peabody: Form A No score Form B ________

Socioeconomic classification: III

Subject: XL
Age: 74 months
Length of amplification: 16 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	70 db	72 db
Hearing measurable up to and including:	2000 cps	2000 cps

Of 50 responses:
mean length of response: 1.17
number of 1 word responses: 11
mean of 5 longest responses: 1.4
number of different words: 12
structural complexity score: 1
mean structural complexity (MSC): .09
number of agreed on responses: 12
number of agreed on words: 14
of these agreed on words there are:
nouns: 10
pronouns: 1
verbs: 2
prepositions: 0
adjectives: 1
adverbs: 0
articles: 0
interjections, etc.: 0
other: 0

Templin-Darley score: 16 on screening test

Peabody: Form A MA: 3-3 Form B ________

Socioeconomic classification: III

Subject: XM
Age: 69 months
Length of amplification: 17 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	57 db	50 db
Hearing measurable up to and including:	2000 cps	2000 cps

Of 50 responses:

mean length of response:	2.11
number of 1 word responses:	14
mean of 5 longest responses:	4.4
number of different words:	45
structural complexity score:	1
mean structural complexity (MSC):	.03
number of agreed on responses:	35
number of agreed on words:	75

of these agreed on words there are:

nouns:	35
pronouns:	5
verbs:	21
prepositions:	5
adjectives:	1
adverbs:	0
articles:	3
interjections, etc.:	5
other:	0

Templin-Darley score: 24 on screening test

Peabody: Form A MA: 2-6 Form B ________

I.Q. score: 104 test: Merrill-Palmer

Vineland score: 96

Socioeconomic classification: VI

Subject: XN
Age: 64 months
Length of amplification: 23 months
Aid: binaural X or monaural ___
Hearing (pure tone average):

	right	left
if only one or two frequencies measurable, specify which	63 db	55 db
Hearing measurable up to and including:	2000 cps	2000 cps

Of 50 responses:
mean length of response: 1.25
number of 1 word responses: 7
mean of 5 longest responses: 1.4
number of different words: 8
structural complexity score: 1
mean structural complexity (MSC): .13
number of agreed on responses: 8
number of agreed on words: 10
Of these agreed on words there are:
nouns: 5
pronouns: 2
verbs: 1
prepositions: 0
adjectives: 0
adverbs: 0
articles: 0
interjections, etc.: 2
other: 0

Templin-Darley score: 14 on screening test

Peabody: Form A ________ Form B MA: 2-1

Socioeconomic classification: V

Subject: XO
Age: 72 months
Length of amplification: 40 months
Aid: binaural _____ or monaural _____
Hearing (pure tone average):

if only one or two frequencies	right	left
measurable, specify which	62 db	65 db
Hearing measurable up to and including:	2000 cps	2000 cps

Templin-Darley score: 7 on screening test

Peabody: Form A MA: 2-0 Form B ________

Socioeconomic classification: V

Subject: XP

Age: 71 months

Length of amplification: 43 months

Aid: binaural X or monaural ___

Hearing (pure tone average):	right	left
if only one or two frequencies measurable, specify which	80 db	87 db
Hearing measurable up to and including:	2000 cps	2000 cps

Templin-Darley score: 15 on screening test

Peabody: Form A ________ Form B MA: 1-1

Socioeconomic classification: III

Table I summarizes the data obtained from subjects reported in each group. As previously noted, the Cleveland group has a mean age at the time these data were obtained of seven months greater than the Denver group. Mean hearing levels for the better ear are remarkably close with the Denver group being on the average 2 db better; however the range of hearing for the two groups would seem to favor the Cleveland group slightly. Considerably more of the Cleveland children were fitted with binaural hearing aids and show a significantly greater length of time in hearing aid utilization.

Even though three of the children in the Denver group gave no responses to the Templin-Darley articulation test, on all of their measures of linguistic development they are found to be superior in achievement. To what extent the differences might be attributable to factors such as familiarity with the recording clinician, as mentioned above, is conjectural. It is similarly only conjecture that the program the Cleveland children were currently enrolled in, which was apart from that originally provided at the Cleveland Hearing and Speech Center, was not sufficiently intense to maintain previous gains with the result that these children had lost some of the linguistic ability they had once had Whatever the reasons, it is obvious that the superiority of the Denver group is not attributable to chance.

In Table II comparisons of selected measures are made in order to study more selectively the interrelationship of these measures. As may be readily noted, even with the data from the non-responsive Cleveland children not included, the measures such as mean length of response and agreed on words are substantially less than found in the Denver group. The greatest mean length of the response and agreed on words were obtained from a child with a moderate loss of hearing who had been wearing hearing aids for seventeen months. It is difficult to equate this information with the child whose loss was even less and yet was seen to obtain the highest score on the Templin-Darley with a mean length of response of one word with only ten words agreed upon even though the child had worn his hearing aids for 29 months. In the Denver group the child with the greatest

Table 1

Summary of Terminal Data

	DENVER	CLEVELAND
N	12	12
male	7	6
female	5	10
mean age (in months)	60.3	67.6
range	59-63	58-74
mean hearing level, better ear	69dB	71dB
range	58-95	43-95
mean hearing level poorer ear	77dB	72dB
range	62-95	57-100
monaural aid	8	2
binaural aid	4	14
length of time using aid (mos.)	19.7	35.1
range	11-44	16-55
N agreed responses	409	118
mean	34.0	7.4
range	0-50	0-35
N agreed words	869	172
mean	74.4	10.8
range	0-170	0-75
mean length of reponse	1.8	.76
range	0-3.4	0-2.1
N one word responses	184	92
mean	15.3	5.8
range	0-32	0-17

Table 1. Cont'd.

	DENVER	CLEVELAND
mean 5 longest responses	3.57	.88
range	0-7.2	0-4.4
N different words	394	105
mean	32.8	6.6
range	0-65	0-45
mean structural complexity	4.8	.25
range	0-15	0-1
Parts of Speech		
nouns	367	106
mean	30.6	6.6
range	0-61	0-17
verbs	175	35
mean	14.6	2.2
range	0-51	0-21
adjectives	35	4
mean	2.9	.25
range	0-16	0-1
adverbs	30	1
mean	2.5	.06
range	0-11	0-1
prepositions	31	5
mean	2.5	.4
range	0-14	0-1
pronouns	158	9
mean	13.1	.6
range	0-59	0-5
articles	54	3
mean	4.5	.18
range	0-18	0-3

Table 1. Cont'd.

	DENVER	CLEVELAND
interjections	48	9
mean	4.0	.6
range	0-12	0-5
Templin-Darley Articulation		
mean	20.3	16.4
range	0-49	7-30
Socio-economic Classification		
I	0	0
II	6	2
III	3	8
IV	0	0
V	1	4
VI	1	1
VII	0	0
unclassifiable	1	1

number of agreed on words also had the largest mean length of response with a moderate loss of hearing and a high Templin-Darley score with a history of amplification of only twelve months. The child, AD, whose summary data *a priori* grounds would lead you to expect good results with a near perfect Templin-Darley score, coupled with moderate hearing loss and a relatively high mean length of response and number of agreed on words, was wearing her hearing aid for 44 months; the extreme variability in these scores might be demonstrated by comparison with FG whose Templin-Darley score was near the bottom among those responding yet whose hearing loss was similar to AB and who had a higher mean length of response with a moderate (67) number of agreed on words and who had worn the hearing aid for 21 months.

The figures on the following pages illustrate comparisons between the groups on selected variables under consideration which are felt to be especially worthy of comment.

It might be expected, for example, that total verbal output would be directly related to and highly correlated with the amount of residual hearing in a

Table 2
Selected Comparisons of Hearing, Articulation, and Language Measures

CLEVELAND

Subject	Templin-Darley	Hearing Level (better ear)*	Mean Length of Response	Agreed on Words
XA	15	90 (500 only)	--	--
XB	14	87 (1000)	--	--
XC	18	90 (1000)	--	--
XD	22	72 (1000)	--	--
XE	9	60 (2000)	1.16	7
XF	30	43 (2000)	1.0	10
XG	12	60 (2000)	1.0	17
XH	19	88 (2000)	1.0	2
XI	16	85 (2000)	1.2	12
XJ	28	47 (2000)	1.37	23
XK	7	95 (2000)	1.0	2
XL	16	70 (2000)	1.17	14
XM	24	50 (2000)	2.11	75
XN	14	55 (2000)	1.25	10
XO	7	62 (2000)	--	--
XP	15	87 (2000)	--	--

DENVER

AB	49	58 (2000)	2.04	103
BC	11	80 (1000)	1.06	16
CD	NR	77 (1000)	1.46	73
DE	NR	95 (1000)	1.0	1
EF	NR	78 (1000)	--	--
FG	7	58 (2000)	2.39	67
GH	5	68 (2000)	1.84	45
HI	23	63 (2000)	2.05	80
IJ	31	67 (2000)	2.4	123
JK	47	58 (2000)	2.2	110
KL	31	58 (2000)	2.16	108
LM	47	60 (2000)	3.4	170

* Figures in parentheses indicate highest frequency tested (or testable) in speech range.

Table 2-A

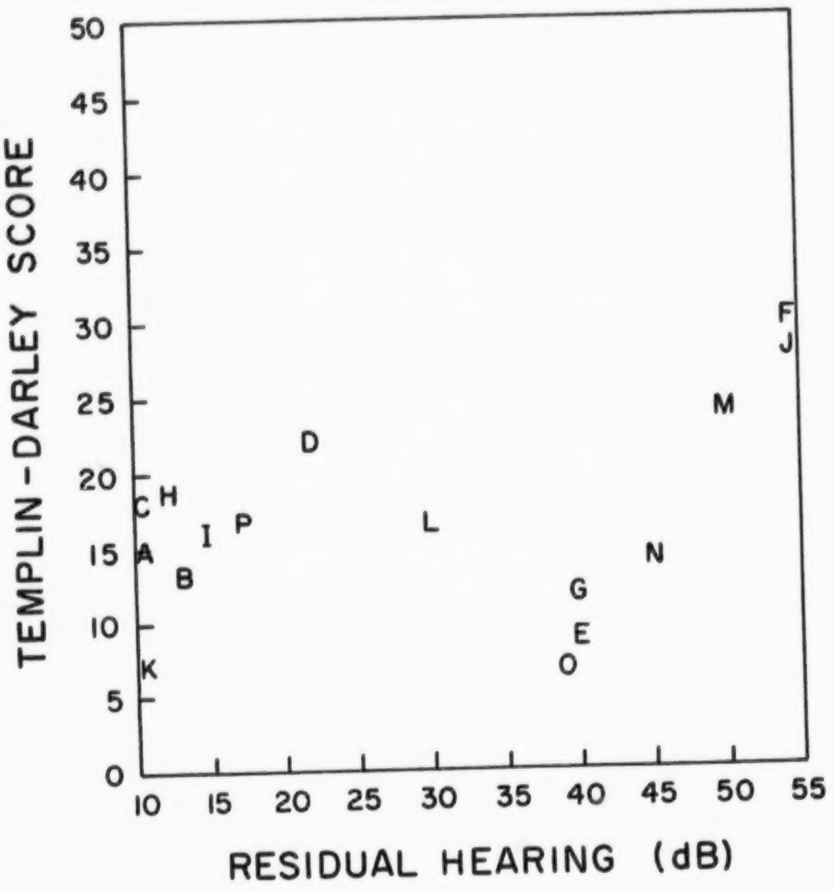
Length of Amplification

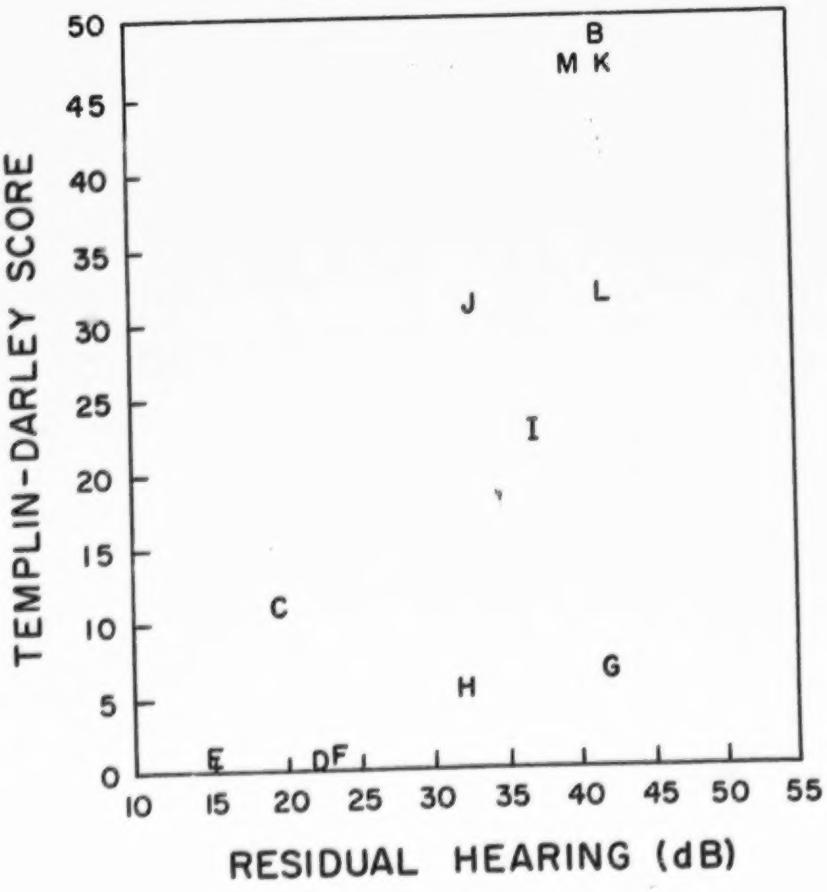
CLEVELAND	
XA	54 mos.
XB	30 mos.
XC	27 mos.
XD	48 mos.
XE	32 mos.
XF	29 mos.
XG	29 mos.
XH	19 mos.
XI	16 mos.
XJ	33 mos.
XK	48 mos.
XL	16 mos.
XM	17 mos.
XN	23 mos.
XO	40 mos.
XP	43 mos.

DENVER	
AB	44 mos.
BC	37 mos.
CD	25 mos.
DE	28 mos.
EF	18 mos.
FG	21 mos.
GH	14 mos.
HI	15 mos.
IJ	16 mos.
JK	23 mos.
KL	14 mos.
LM	12 mos.

given child where other pertinent factors such as intelligience were held relatively constant. The data reported in Figure 2 tend to bear out this contention with a considerably greater spread of total number of words used indicated in the Denver group. With the exception of one subject (M), the Cleveland data show marked clustering at the lower end of the output scale with only a very slight tendency for linearity being noted in isolated infants. In addition to the already noted difference in verbal output between the groups a more linear trend between hearing loss and word usage is noted in the Denver group although not as linear as might be expected logically.

The data presented in Figure 3 are much more indicative of what might be expected on *a priori* grounds with the two variables being Templin-Darley articulation score opposed to amount of residual hearing. In both groups linearity between the two variables is seen to exist, with the better scores as well as better linearity noted in the Denver group. These results would tend to substantiate the contention of Norton (1962) that articulation may not be properly considered a language function, as has been previously


CLEVELAND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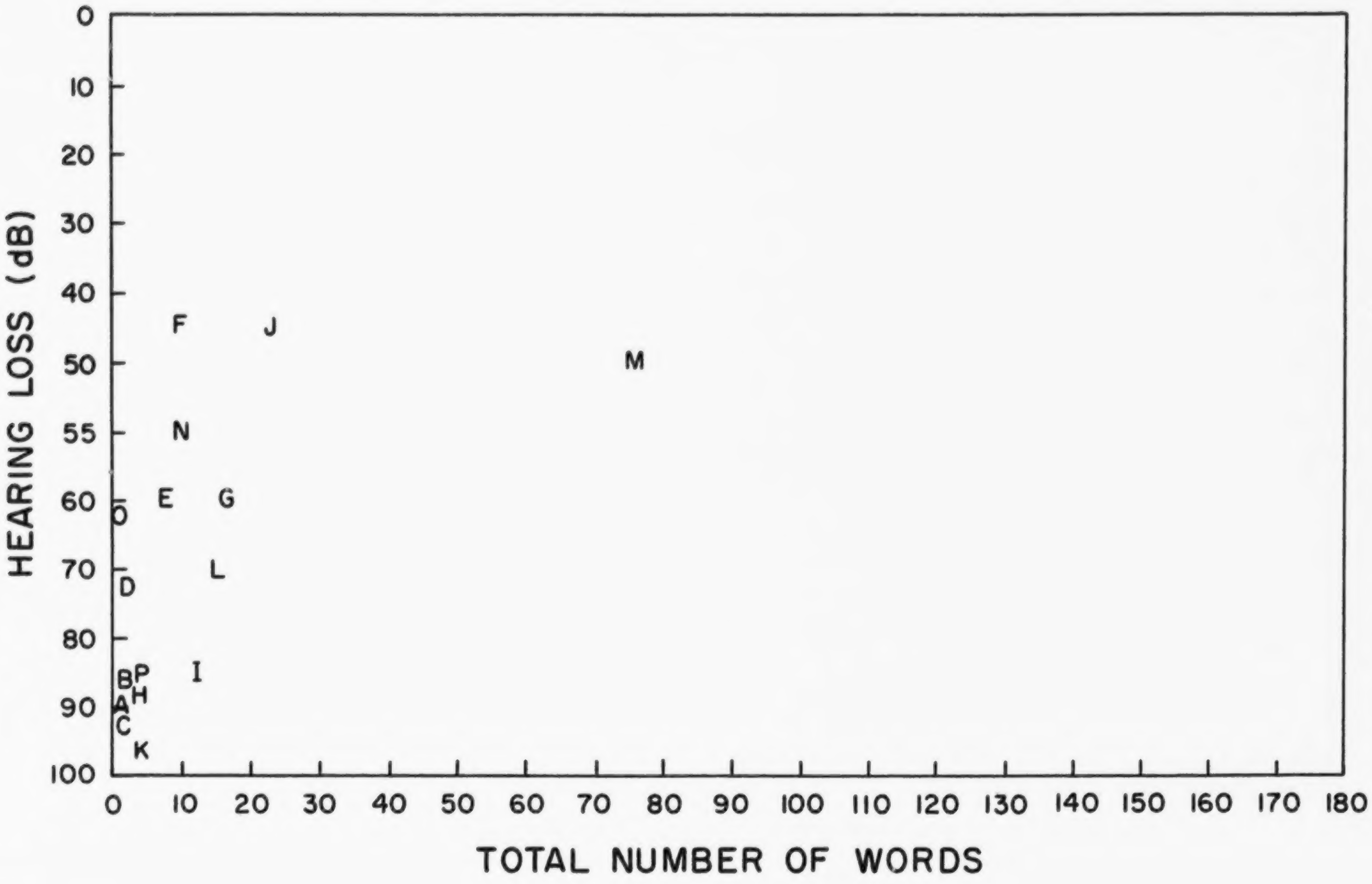

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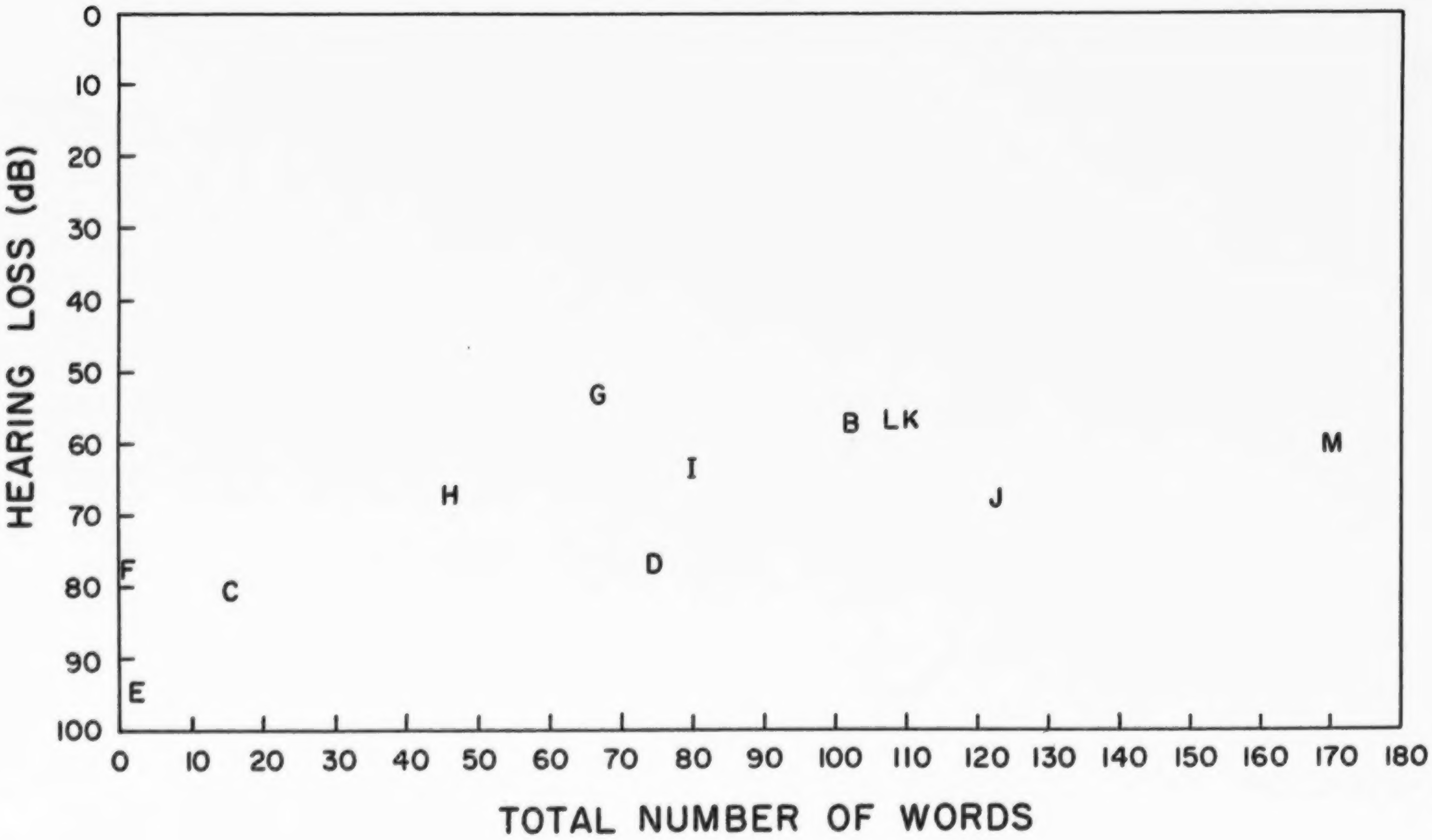

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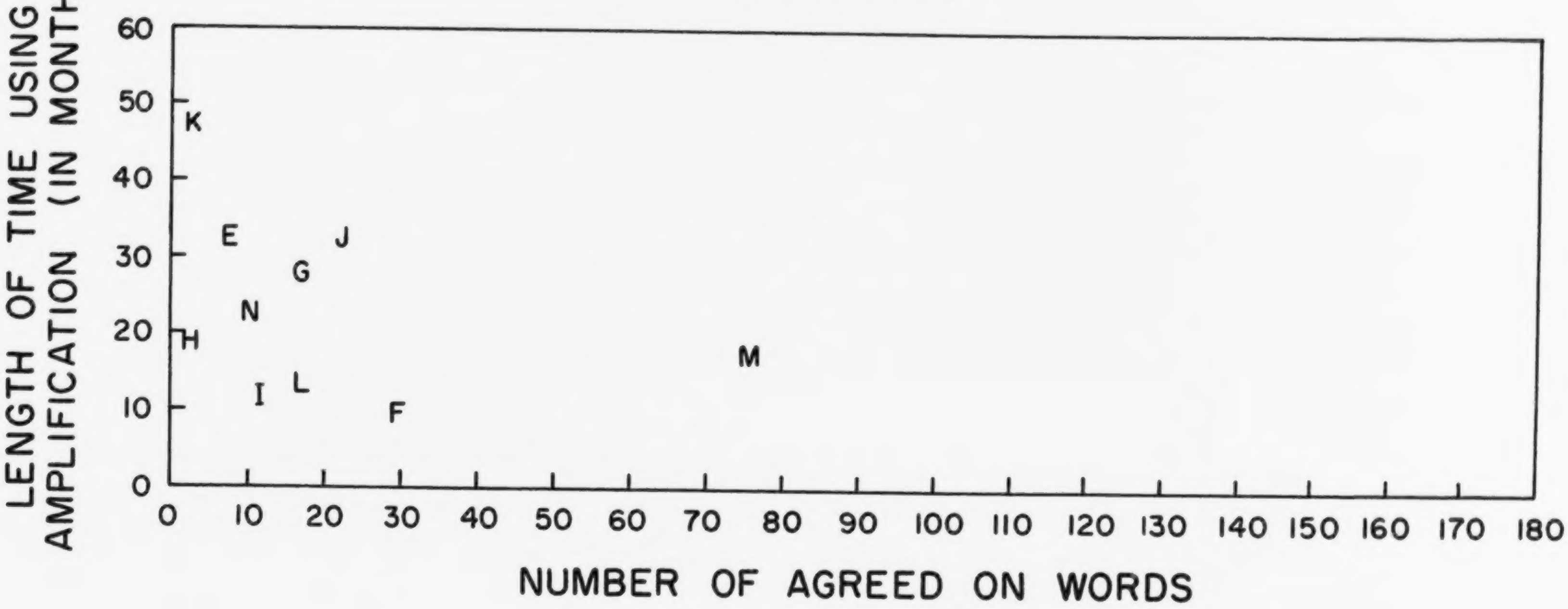
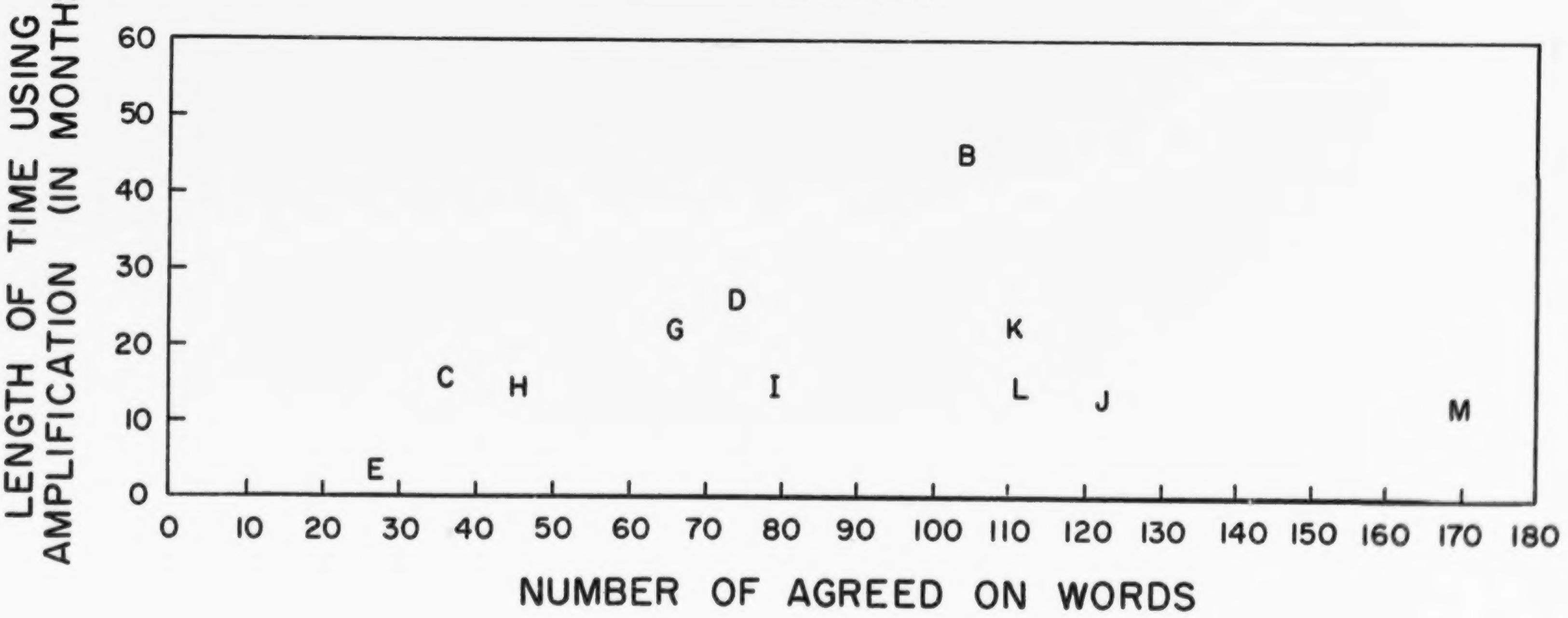


DENVER



held by others, in that the articulation score does not purport to be any measure of the child's ability to conceptualize the word spoken but is dependent upon his ability to develop an auditory memory for the word and be able to repeat it after the person presenting the test. This factor, in part, may account for the discrepancies noted in the Cleveland group wherein the Templin-Darley score was appreciably higher than any measures of linguistic functioning.

In Figure 4, a comparison is made between length of time using amplification compared to the number of agreed-on words. Again, the linearity between the two variables is much more pronounced in the Denver group although even here the distribution of scores may not be as linear as would be expected. This may be due to the variable of time wearing the hearing aid being equated with time of effective utilization of the aid. A more crucial variable, of course, that is not considered in this representation is the extent of hearing loss, which would not necessarily be compensated for equal extent through utilization of the hearing aid. This variable may be accounted for, in part, however in that the child with the greater loss of hearing is more likely to be the one having worn the aid a longer period of time in most cases. These data, compared to those presented in Figure 3, again point out the discrepancy in response between two items of verbal output wherein one might be considered more a language variable (agreed-on words) compared to intelligibility of spoken individual words (Templin-Darley). The data in Figure 4 also point out the relativeness of articulatory skill in children with hearing loss in that one measure of the variable is the precision of the child's articulation in order for the words to be agreed on between two listeners. Responses in terms of individual words, some being spoken in repetition to a precise articulatory model, would be expected to be superior to those in spontaneous and relatively unstructured speech situations.

Several observations are particularly pertinent here. While initial theorizing led to the conjecture that early amplification would be a crucial variable, this has not been borne out by the data. On measures of relative success, not only the terminal data obtained but on subsequent reports of educational placement, the following generalities are seen to obtain in the Denver group: All show fairly flat hearing losses, generally no greater than 70dB in the better ear with most showing measurable hearing to 8000 cycles. In contrast, the notable failures, even though early diagnosis and remedial procedures were the case for several, are lacking in these characteristics. The extent to which linguistic and later scholastic achievement can be related solely as a function of hearing loss has not been established; knowledge of the extent of loss without supplemental information as to its etiology and effect on the family constellation is partial at best. In the absence of more precise etiologic information, however, this is an observation that can only be pointed out. Similarly, the extent to which the child's lack of learning and, perhaps, resultant behavior has on familial attitudes, responses, and reactions to the loss is undoubtedly a dynamic inter-relationship which may tend to be self-reinforcing insofar as less desirable behavior and response are concerned. Certainly the three notable failures in the Denver group (CD, DE, and EF) do not show histories of any simple cause-effect relationship. Other children with equally severe losses of hearing who were not identified as early as two of the before mentioned three (DC,FG, and IJ) show strikingly dissimilar results from those cited above.

On the basis of the sum total of hypotheses underlying the study, the greatest gain would have been expected from AB. While this child does show highly satisfactory and, in some respects, superior linguistic achievement this would have been expected on the basis extent of hearing loss, early identification, parental cooperation, and her own innate ability. The results shown to have been obtained from three other children (JK,KL, and LM) however, indicate that these successes are not as simple as hypothesized. In each of these three cases the loss of hearing alone would have led to lesser expectation than each child has shown to be capable of. A search for common factors relating to these successes is less than satisfactory, other than the common factor of relatively high intellectual capability, well directed parental concern and cooperation, and residual hearing through the high frequencies. The three children are highly dissimilar insofar as personality is concerned with one being highly aggressive, another extremely shy and withdrawn, and the third falling somewhere in between these two extremes.

Insofar as the Cleveland group is concerned, the data would tend to show little support for early identification of hearing loss and early binaural hearing aid fitting. Had these children been in continuous enrollment at the Center and had these results been the same under these circumstances such a conjecture might have some validity. Under the circumstances, however, it would appear to be also likely that any gain a given child made during his early periods of amplification would not persist in the activities of any program of management which did not reinforce and build upon these gains in subsequent years. It is also apparent from both groups that the mere placement of a hearing aid is no guarantee that effective use of the instrument will be learned. It does not seem improbable to expect that in some cases wherein auditory intelligibility was not markably improved the distorted signal received might further add to the loss of hearing by virtue of the child's suppression or, at least, inattention to the auditory signal. In the case of the Cleveland group, the effect of simultaneous speech reading with auditory training must remain conjectural.

On the basis of the cautions mentioned on the preceeding page, it would appear that the approach is less satisfactory than the unisensory approach being investigated here. The overall consistency of results would not appear to be entirely attributable to these variables and the superiority of the educational audiology approach, at least for children fitting the criteria mentioned on the preceeding page, appears to be established.

Among other things, these comparisons point up the inadequacy of present test measures for assessments such as those undertaken here and the deficiencies in using certain test batteries not standardized on a group of deficient hearing children when used for that purpose. The discrepancies noted in intelligence quotient measures are one case in point; the variation noted between the two forms of the Peabody, where they are seen to relate closely until about the age of four years and then become highly divergent causes its usefulness to be highly questioned. The common practice of making judgment on the basis of extent of hearing loss through the speech frequencies should also be questioned as the result of the findings presented here; similarly, the assumption that an aided pure-tone audiogram is also a good predictive measure should be questioned without supplemental data regarding auditory discrimination, effectiveness of hearing aid usage, and adequate maintenance of the aid. In order for hearing aid utilization to be most effective, some measure of auditory attentiveness particularly in the presence of competing stimuli, need to be developed before any realistic assessment of such utilization can be assumed.

In summary, it would appear that the educational audiology approach has distinct merit over the traditional oral approach and that a high proportion of children with hearing losses might be integrated into totally hearing classrooms at an earlier age if they have the opportunity to be included in this form of management. By no means is it suggested that this management should be the program of choice in all cases of children with severe losses of hearing but it would appear to be worthy of trial in any event. A flexible program utilizing a diagnostic nursery situation in which each child being evaluated is given the opportunity to learn listening skills and achieve language essentially through the auditory sense would be highly desirable. After such a trial, however, the child whose gains are not sufficient to merit further continuation of the program should be terminated. It would seem highly advantageous, also, to question the assumption that every child with a hearing loss should be fitted with a hearing aid regardless of the program of management. For those children not achieving in an acoupedic environment it would seem equally likely that amplification might interfere sufficiently with his visual learning as to make him retarded in his progress in learning language through a second sensory modality. In any event, without clearly demonstrable gain in hearing aid usage the purchase of a hearing aid without adequate justification for its use would seem not to be in order.

The data summarized in Table 3, comparing certain dimensions of linguistic achievement for limited hearing children and their totally hearing peers, are not different from what would normally be expected. Such comparisons are indicated, however, when they indicate directions of difference and where major deficiencies and strengths on the part of the limited hearing children exist insofar as future management consideration are concerned. In addition, it should be pointed out that

Table 3

Comparisons of Totally-Hearing and Limited Hearing Children on Certain Measures of Linguistic Achievement

	Norton (1962)	Winitz (1959)	Templin (1953-57)	Denver	Cleveland
Mean Length of Response	5.17	5.39	5.7	1.8	.76
Mean Length of 5 Longest Responses	--	14.92	11.73	3.57	.88
Number of One-Word Responses	--	--	2.4 (mdn)	15.3 (mean)	5.8 (mean)
Number of Different Words Used	100.33	106.27	132.4	32.8	6.6
Structural Complexity Score	36.43	40.40	56.9	4.8	.25
Templin-Darley Articulation Scale (Screening)	---	41.08	37.7	20.3	16.4

the data presented for both groups of hearing handicapped children include several children who gave no verbal responses during the test session involved.

From mean length of response the totally hearing children show good consistency from study to study. As expected, the hearing impaired group are considerably depressed on this variable; compared with mean of 5-longest responses an appreciable gain over mean length of response is seen on the part of the Denver group and a slight gain on the part of the Cleveland group. The second measure, which reduces the depressant effect of the nonresponsive children, is perhaps more indicative of the capability of the hearing impaired groups if the criteria for placement, cited on Table 3, were to be employed. A further indication of the extent of such retardation on language can be inferred from the results on numbers of one-word responses and number of different words used. In the former, the Denver group is seemed to have more than four times as many one-word responses as the Templin totally hearing group and nearly three times as many as the Cleveland group. Insofar as number of different words used is concerned, more variation on the part of the totally hearing children is seen, particularly in the Templin findings, with the Denver group using about one-third as many different words as the other two totally hearing groups and the Cleveland group one-fifth that of the Denver group. Insofar as articulatory skills are concerned, group differences between Cleveland and Denver are, comparatively speaking, less pronounced than on other measures with both still substantially below that of any of the totally hearing subjects.

The retardation shown by the hearing impaired children on all variables tested when compared with totally hearing children of approximately the same chronological age points out the importance in viewing the hearing impaired children on the basis of a "hearing age" rather than on chronological age. Future comparisons of this sort might well be based on the time each child has had to develop his auditory skills as measured, for the hearing impaired group, on the basis of beginning date of effective hearing aid utilization (to the extent that this can be measured) on the assumption that a certain length of time may be necessary for all children to develop the appropriate auditory memories. One exception might be the time required for single word response and/or immediate auditory recall; this is evidenced in three cases in the Denver group (AD,JK, and LM) whose Templin-Darley scores are equal to or superior to those of totally hearing children of the same chronological age.

On the basis of the results presented here, future research along the lines might well be concentrated on such factors as optimum time for hearing aid selection, evaluation of the effects of a given amplified signal on a given child, measures for assessing hearing aid utilization, and exploration of auditory factors in language learning in the presence of an impaired sensory system and how the impaired system and unimpaired supplemental system interact in language learning.

SUMMARY

The problem investigated was to determine if a program of educational audiology would aid the speech and language development of the moderately to severely hard of hearing child to the extent that the child, when he enters school, might be integrated into a normal hearing classroom. The study had as its primary

aim an evaluation of such a program (sometimes referred to as the "acoupedic method") as a method for training the deaf and hard of hearing child primarily through the auditory sense.

The approach under investigation developed in recent years out of the emphasis on early diagnosis and its subsequent stress upon early remedial programs for handicapped children. It differs from most modern approaches, however, in that it is basically unisensory, stressing audition, rather than multisensory, wherein audition and vision are utilized simultaneously.

The theoretical premises underlying the program are:

1. The auditory sense is the most suitable perceptual modality by which a child learns speech and language.
2. The multisensory approach to management favors the development of the unimpaired modality as the primary communication system at the expense of the impaired modality whereas the unisensory approach stresses development of the impaired modality to its fullest potential.

3. The development of sound awareness, vocal production, and, eventually, the beginnings of speech and language can best be achieved in the child's home so long as suitable acoustic stimulation is provided.
4. Present day nursery school procedures patterned after those developed for totally hearing children are preferable to those designed around "special education".

From a total of 33 children enrolled in an experimental unisensory program at the University of Denver, 12 whose total remedial management has been in the program described and who had achieved the fifth birthday by the conclusion of the study were selected for detailed analysis of audiometric, case history, parental environment, and speech and language data. A similar group, whose early management had been multisensory, of 16 children obtained through the cooperation of the Cleveland Hearing and Speech Center provided comparative data on hearing loss, speech and language development. While no strict matching was possible between individual members of each group, comparisons of data obtained by the fifth birthday were made and analyzed.

On all measures of speech and language acquisition, the Denver group was markedly superior to the Cleveland group although the superiority was less evidenced on the Templin-Darley articulation test. On all other measures (mean length of response, mean of 5 longest responses, number of one-word responses, number of different words, structural complexity score) results from the Denver group would appear to indicate the advisability of unisensory as opposed to multisensory management. Such generalizations, however, are not made on the basis of other variables such as familiarity with the test situation, continual enrollment in the original clinical program, etc.

On the basis of the findings, however, certain recommendations are made regarding the utilization of unisensory management; for children whose residual hearing extends into the high frequencies and whose hearing losses are relatively flat, this approach appears to be a significant benefit. Other children, not fitting all these criteria, might be enrolled in such a program for diagnostic purposes but if marked gains in speech and language acquisition are not seen following a suitable trial period of amplification, then a more traditional educational program might better serve these children's needs.

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APPENDIX A

Summary Table 1: Case History Data

Summary Table 2: Serial Audiometric and Language Data

Summary Table 1: Case History Data
(N=33)

ITEM		
1. Child's age at time of first interview (in months)		
		$\bar{X}$= 36.9
		R= 10 - 57
2. Primary informant	Mother	31
	Father	1
	Step-mother	1
3. Mother's age (in years) at time of interview		
		$\bar{X}$= 28.7
		R= 22 - 41
4. Father's age (in years) at time of interview		
		$\bar{X}$= 32.5
		R= 22 - 55
5 Sex of child		
	Male	18
	Female	15
6. Referring agency		
	Otologist	10
	Family physician	9
	Univ. of Colo. Med. Ctr.	9
	Self	2
	School system	2
	Other univ.	1
7. Reason for referral		
	Diagnosis only	9
	Diagnosis and therapy	13
	Therapy only	11
8. Referring complaint		
	Loss suspected	13
	Loss confirmed	15
	Speech retarded	2
	Combination	3

Summary Table 1: (cont'd)

9.	Onset of problem		
		Congenital	10
		Prior to first word	18
		During early speech development	5
10.	Approximate age (in months when hearing loss first suspected		
		$\bar{X}=$	15.6
		$R=$	2 - 39
		$\sigma=$	9.7
11.	Reason hearing loss suspected		
		Speech retarded	9
		Lack of startle response	8
		No response to auditory stimuli	9
		Combination of factors	7
12.	Person who first suspected hearing loss		
		Mother	25
		Father	2
		Grandmother	2
		Physician	2
		Hearing Clinic	1
		Neighbor	1
13.	Progress of hearing loss (without amplification)		
		Gradually worse	2
		No change	25
		Gradually better	3
		Never evaluated	3
14.	Others in family with hearing loss		
		No one	28
		Brother	1
		Sister	2
		Grandparent(s)	1
		Grandparent(s) and Uncle	1

Summary Table 1: (cont'd)

15. Number of child's siblings		
	$\bar{X}=$	2.03
	R=	0 - 8
16. General health of mother during pregnancy		
	Excellent	20
	Good	8
	Fair	3
	Poor	1
	Very poor	1
17. Diseases mother had during pregnancy		
	None	19
	Rubella	5
	Influenza	5
	Toxemia	1
	Influenza and strep. throat	1
	Strep. throat	1
	Kidney infection	1
18. Medications taken during pregnancy		
	None	25
	Antihistamine	3
	Pyrobenzamine	1
	Unknown	3
19. Has mother ever suffered a miscarriage?		
	Yes	9
	No	24
20. Approximate length of pregnancy (in weeks)		
	$\bar{X}=$	40.3
	R=	36 - 49
21. Length of labor (in hours)		
	$\bar{X}=$	7.45
	R=	0 - 32
	N=	31
22. Was labor induced?		
	Yes	4
	No	27
	Unknown	1

Summary Table 1: (cont'd.)

23.	Type of deliver		
		Head	27
		Feet	1
		Breech	1
		Caesarian	2
		Unknown	2
24.	Were instruments used?		
		Yes	7
		No	18
		Unknown	8
25.	Severity of cranial birth injury, if any		
		None	28
		Severe	2
		Moderate	1
		Slight	1
		Unknown	1
26.	Were any congenital anomalies noted?		
		None	19
		Unknown	13
		Peripheral nerve palsy	1
27.	Other conditions present at birth		
		None	25
		Anoxia	1
		Difficulty in initiating breathing	2
		Cyanosis	3
		Unknown	2
28.	Are parents Rh compatible?		
		Yes	23
		No	8
		Unknown	2
29.	Child's birthweight (in ounces)		
			$\bar{X}$= 107.41
			R= 67 - 142
			σ= 16.4
			N= 31

Summary Table 1: (cont'd.)

30. Age (in months) when child sat alone; unsupported

$\bar{X}$= 6.63
R= 4 - 12
N= 30

31. Age (in months) when child crawled or crept

$\bar{X}$= 8.74
R= 5 - 12
N= 27

32. Age (in months) when child took first unassisted steps

$\bar{X}$= 13.12
R= 8 - 18
N=

33. Age (in months) when child spoke first meaningful word

$\bar{X}$= 17.79
R= 9 - 45
σ= 8.29
N= 24

34. Age (in months) when child spoke first short combination of words

$\bar{X}$= 26.16
R= 10 - 36
N= 12

35. Age (in months) when child spoke first sentences

$\bar{X}$= 35.33
R= 23 - 43
N= 9

36. Evaluation of child's speech by parents

Never evaluated	7
Considered adequate	5
Concerned over adequacy	21

Summary Table 1: (cont'd)

37. Age (in months) when bladder training was initiated

$\bar{X}$= 20.95
R= 10 - 36
σ= 2.14
N= 24

38. Age (in months) when bladder training was completed

$\bar{X}$= 29.12
R= 18 - 48
σ= 8.54
N= 24

39. Age (in months) when bowel training was initiated

X= 20.27
R= 10 - 36
σ= 6.9
N= 22

40. Age (in months) when bowel training was completed

$\bar{X}$= 27.95
R= 12 - 38
= 8.12
N= 21

41. Child's disease history

None	None	9
	Measles only	7
	Chicken pox only	2
	Bronchitis	1
	Measles and strep.throat	2
	Measles and tonsilitis	1
	Croup	1
	Measles and chicken pox	1
	Measles and severe otitis media	1
	Chicken pox and influenza	1
	Mumps, measles, and chicken pox	1
	Influenza and pneumonia	1
	Measles and meningitis	1
	Measles, pneumonia, strep throat, and rheumatic fever	1

Summary Table 1: (cont'd)

	Mumps, measles, pneumonia, and chicken pox	1
	Pneumonia, urinary tract infection, chicken pox, and measles	1
42. Allergy history		
	None	26
	Some allergy	3
	Unknown	4
43. Frequency of middle ear infection		
	Never	13
	Frequently	6
	Rarely	13
	Unknown	1
44. Frequency of ear discharge		
	Never	22
	Frequently	2
	Rarely	7
	Unknown	2
45. Has child had tonsillectomy and adenoidectomy?		
	No, neither	25
	Yes, both	4
	Tonsils only	1
	Adenoids only	1
	Unknown or unclear	3
46. Has child had other surgery?		
	No	26
	Question not asked	1
	Yes:	6
	Urinary tract, myringotomy	
	Bilateral nephrostomy and abdominal muscle reconstruction	
	Hernia	
	Myringotomy	
	Stapedectomy	
	Tracheotomy	

Summary Table 1: (cont'd)

47.	Child's drug history	
	None	8
	Penicillin	2
	Streptomycin	3
	Auromycin	2
	Acromycin	2
	Mycostain and chlormycetin	1
	Neomycin, steptomycin, auromycin	1
	Bicillin, terramycin	1
	Terramycin	1
	Acromycin, penicillin	1
	Streptomycin (?), Auromycin	1
	Unknown	10
48.	How often does the child face the speaker in order to understand?	
	Never	5
	Occasionally	11
	Often	16
	Unclear	1
49.	What sounds does child generally seem aware of (without amplification)?	
	None	4
	Loud sounds only	11
	Large variety of sounds (voices, doorbells, telephone, airplane, dog bark, whispered voice)	9
	Voice, doorbell, and phone only	1
	Vibrations only	1
	Doorbell and phone only	1
	Airplane and phone	1
	Whispered voice behind back	1
	Dog barking only	1
	Doorbell and phone only	1
	Plane flying overhead only	2

Summary Table 1: (cont'd.)

50. Has child attained primary level of sound development (i.e., show consistent reaction to sound and listening awareness)?	Yes	22
	No	9
	Unknown	2
51. Has child attained vocal level of development (i.e., own vocalization developed into a hearing-controlled voice)?	Yes	14
	No	18
	Unknown	1
52. Has child attained symbolic level of development (i.e., passive understanding or awareness of meaning of speech)?	Yes	14
	No	14
	Unknown	5
53. Has child attained oral level of development (i.e., does he employ vocal organs to convey an idea)?	Yes	11
	No	18
	Unknown	4
54. How is child's motor coordination compared to child of equivalent age and sex?	Slightly deficient	3
	Average	18
	Superior	8
	Unknown	4
55. Has child had previous hearing test?	Yes	22
	No	11
56. Has medical diagnosis been made of problem?	Yes	16
	No	15
	Unknown	2

Summary Table 1: (cont'd.)

57. Minnesota classification of socio-economic status

Professional	3
Semiprofessional and managerial	6
Clerical, skilled trades and retail business	13
Rural	0
Semiskilled occupations, minor clerical, minor business	2
Slightly skilled trades	3
Day laborer	0
Unclassified (unclear response, university student, etc.)	6

58. Impression of informant's reliability of response

Above average	13
Average	14
Below average	5
No judgment	1

SUMMARY TABLE 2
SERIAL AUDIOGRAM (ASA)

SUBJECT: AB

Test	Ear	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Average
1 (7-'62)	R		30	35	60			42
	L		60	40	65			62
2 (10-'62)	R		55	45	60			53
	L		55	60	70			62
3 (2-'63)	R		70	80	80			77
	L		70	70	50			63
4 (7-'63)	R		60	80	55			65
	L		65	70	60			65
5 (11-'63)	R		70	60	45			58
	L		65	60	60			62
6 (4-'64)	R		50	50	55	35		48
	L		70	70	55	30		65
7 (8-'64)	R	50	60	60	45	35	25	55
	L	50	65	60	50	30	--	58
8 (11-'64)	R	60	70	70	45	40	15	62
	L	55	65	65	50	25	20	60
9 (4-'65)	R	50	65	75	55	45	30	65
	L	65	65	60	55	40	30	58

SERIAL LANGUAGE SUMMARY

Age: Yr. 3 Mo. 4

MLR	SCS	MSCS
1.78	3	.06

N agreed on: 50
N one-word: 29

Age: Yr. 3 Mo. 7

MLR	SCS	MSCS
1.78	0	0

N agreed on: 41
N one-word: 20
Templin: 25
Peabody: 2-0

Age: Yr. 3 Mo. 10

MLR	SCS	MSCS
2.82	12	.24

N agreed on: 50
N one-word: 10

Age: Yr. 4 Mo. 1

MLR	SCS	MSCS
3.26	14	.28

N agreed on: 50
N one-word: 9
Templin: 28
Peabody: 2-4

Age: Yr. 4 Mo. 4

MLR	SCS	MSCS
2.76	6	.12

N agreed on: 50
N one-word: 12

Age: Yr. 4 Mo. 7

MLR	SCS	MSCS
2.44	10	.22

N agreed on: 45
N one-word: 17
Templin: 41
Peabody: 3-0

Age: Yr. 5 Mo. 0

MLR	SCS	MSCS
2.04	10	.2

N agreed on: 50
N one-word: 26
Templin: 49
Peabody: 4-11

SERIAL AUDIOGRAM (ASA)

SUBJECT: BC

Test	Ear	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Average
1 (8-'62)	R	70	90	90	100			93
	L	70	70	80	85			78
2 (2-'63)	R		75	80	90			82
	L		80	85	85			83
3 (6-'63)	R	75	85	90	100			92
	L	70	90	90	100			93
4 (12-'63)	R	80	90	--	95	--		95
	L	70	90	100	100	95		97
5 (2-'64)	R	75	85	95	95	100		92
	L	80	80	95	95	95		90
6 (8-'64)	R	70	85	100	95	100		94
	L	70	85	95	95	90		90

SERIAL LANGUAGE SUMMARY

Age: Yr. 3 Mo. 0

MLR	SCS	MSCS
1	0	0

N agreed on: 4
N one-word: 4

Age: Yr. 3 Mo. 3

MLR	SCS	MSCS
1	0	0

N agreed on: 14
N one-word: 14
Templin: NR
Peabody: 2-14

Age: Yr. 3 Mo. 6

MLR	SCS	MSCS
1	0	0

N agreed on: 12
N one-word: 12

Age: Yr. 3 Mo. 9

MLR	SCS	MSCS
1	0	0

N agreed on: 20
N one-word: 20
Templin: 10
Peabody: 2-4

Age: Yr. 4 Mo. 0

MLR	SCS	MSCS
1	0	0

N agreed on: 8
N one-word: 8
Templin: NR
Peabody: 2-2

Age: Yr. 4 Mo. 3

MLR	SCS	MSCS
1	0	0

N agreed on: 17
N one-word: 17

Age: Yr. 4 Mo. 8

MLR	SCS	MSCS
1.28	0	0

N agreed on: 7
N one-word: 5
Templin: 10

Age: Yr. 5 Mo. 0

MLR	SCS	MSCS
1.06	0	0

N agreed on: 15
N one-word: 14
Templin: 11
Peabody: 4-8

SERIAL AUDIOGRAM (ASA)

SUBJECT: CD

				Hz				
Test	Ear	250	500	1000	2000	4000	8000	Average
1 (7-'62)	R		85	90	90			88
	L		95	85	95			92
2 (11-'62)	R	60	70	80	80	95		77
	L	60	55	80	80	95		72
3 (2-'63)	R	50	65	75	75	80		72
	L	60	70	75	75	75		73
4 (7-'63)	R	60	75	80	85			80
	L	70	70	80	80			77

SERIAL LANGUAGE SUMMARY

Age: Yr. 4 Mo. 6

MLR	SCS	MSCS
1	0	0

N agreed on: 2
N one-word: 2

Age: Yr. 4 Mo. 10

MLR	SCS	MSCS
1.48	0	0

N agreed on: 41
N one-word: 25
Templin: NR
Peabody: 2-3

Age: Yr. 5 Mo. 1

MLR	SCS	MSCS
1.46	0	0

N agreed on: 50
N one-word: 32
Templin: NR
Ammons: 2-5

Age: Yr. 5 Mo. 4

MLR	SCS	MSCS
1.2	0	0

N agreed on: 48
N one-word: 42

SERIAL AUDIOGRAM (ASA)

SUBJECT: DE

Test	Ear	250	500	Hz 1000	2000	4000	8000	Average
1 (10-'61)	R		80	100	100			93
	L		90	100	--			--
2 (3-'62)	R	70	85	80	95			87
	L	80	80	90	90			87
3 (8-'62)	R	65	85	90	100	NR	NR	92
	L	75	75	90	95	NR		87
4 (10-'62)	R		80	90	95			88
	L		75	85	90			83
5 (3-'63)	R	80	100	100	--			
	L	70	100	--				
6 (7-'63)	R	90	90	100				
	L	90	95	--				

SERIAL LANGUAGE SUMMARY

Age: Yr. 3 Mo 0
MLR SCS MSCS
0 0 0
N agreed on: 0
N one-word: 0

Age: Yr. 3 Mo. 3
MLR SCS MSCS
0 0 0
N agreed on: 0
N one-word: 0

Age: Yr. 3 Mo 6
MLR SCS MSCS
0 0 0
N agreed on: 0
N one-word: 0

Age: Yr. 3 Mo. 9
MLR SCS MSCS
N agreed on: 0
N one-word: 0
Templin: NR
Peabody: NR

Age: Yr. 4 Mo. 0
MLR SCS MSCS
NR

Age: Yr. 4 Mo. 3
MLR SCS MSCS
NR

Age: Yr. 4 Mo. 6
MLR SCS MSCS
NR

Age: Yr. 5 Mo. 0
MLR SCS MSCS
1 0 0
N agreed on: 1
N one-word: 1
Templin: NR
Peabody: 1-10

SERIAL AUDIOGRAM (ASA)

SUBJECT: EF

		Hz						
Test	Ear	250	500	1000	2000	4000	8000	Average
1 (1-'63)	R	75	80					
	L							
2 (5-'63)	R		75	80	80	80		78
	L		80	85	85	80		83
3 (11-'64)	R	80	85	95	90	90		90
	L	--	85	100	100	--		95
4 (6-'65)	R	60	80	70	90			80
	L	60	80	90	90			87

SERIAL LANGUAGE SUMMARY

Age: Yr. 4 Mo. 5	Age: Yr. 4 Mo. 9	Age: Yr.__ Mo.__
MLR SCS MSCS	MLR SCS MSCS	MLR SCS MSCS
0 0 0		0 0 0
N agreed on: NR	N agreed on: NR	N agreed on: 0
N one-word: NR	N one-word: NR	N one-word: 0
Templin: NR	Templin: NR	Templin: NR
Peabody: 1-9	Peabody: NR	Peabody: 1-11

SERIAL AUDIOGRAM (ASA)

SUBJECT: FG

Test	Ear	Hz 250	500	1000	2000	4000	8000	Average
1 (4-'59)	R		15	25	?			--
	L		--	--	--			--
2 (5-'59)	R		30	35	--			--
	L		40	40	50			43
3 (7-'59)	R		25	30	15			23
	L		20	30	20			23
4 (3-'60)	R		40	60	65			55
	L		65	65	85			72
5 (7-'60)	R	30	60	75	80	80	85	72
	L			90				
6 (7-'60_	R		65	80	80	90		75
	L	50?	70	85	90	85		82
7 (12-'60)	R		65	70	80			72
	L	75	75	75	90			80
8 (2-'61)	R		40	70	65			58
	L		80	75	95			83
9 (7-'61)	R		60	70	70	80		67
	L		85	85	--	--		85

SERIAL LANGUAGE SUMMARY

Age: Yr. 4 Mo. 6
MLR SCS MSCS
1.38 3 .17
N agreed on: 18
N one-word: 14

Age: Yr 5 Mo. 0
MLR SCS MSCS
(poor recording)
N agreed on:
N one-word:
Templin: 7

Age: Yr. 5 Mo. 2
MLR SCS MSCS
2.39 8 .28
N agreed on: 28
N one-word: 13

Age: Yr. 5 Mo. 4
MLR SCS MSCS
1.26 2 .04
N agreed on: 50
N one-word: 41
Templin: 24
Peabody: 2-7

SERIAL AUDIOGRAM (ASA)

SUBJECT: GH

Test	Ear	250	500	1000	2000	4000	8000	Average
				Hz				
1 (4-'60)	R	60	70	85	80	80		78
	L	50	55	70	60	70		60
2 (7-'60)	R	55	75	80	75	75	85	77
	L	60	75	85	85	80		87
3 (12-'60)	R		75	90	95			87
	L		75	90	95			87
4 (7-'61)	R	35	70	80	70	75		60
	L	40	70	70	65	65		80

SERIAL LANGUAGE SUMMARY

Age: Yr. 4 Mo. 3

MLR	SCS	MSCS
2.03	8	.26

N agreed on: 30
N one-word: 19

Age: Yr. 4 Mo. 7

MLR	SCS	MSCS
2.86	21	.42

N agreed on: 50
N one-word: 18
Templin: 5
Peabody: 4-8

Age: Yr. 4 Mo. 9

MLR	SCS	MSCS
1.14	2	.04

N agreed on: 47
N one-word: 42

Age: Yr. 5 Mo. 0

MLR	SCS	MSCS
1.84	1	.04

N agreed on: 26
N one-word: 15
Templin: 5
Peabody: 3-9

SERIAL AUDIOGRAM (ASA)

SUBJECT: HI

				Hz				
- Test	Ear	250	500	1000	2000	4000	8000	Average
1 (10-'59)	R		40	50	55	70		48
	L		40	55	60	60		52
2 (8-'60)	R	35	45	60	70	70		58
	L	35	40	45	75	65		53
3 (12-'60)	R		55	55				--
	L		90	90	95			92
4 (2-'61)	R	30	--	55	55	65	50	50
	L	35	35	50	65	65	60	50
5 (7-'61)	R	45	60	60	80			67
	L	60	50	60	80			63
6 (1-'62)	R	30	35	55	45	45		45
	L	45	35	50	50	65		47
7 (8-'62)	R	30	40	65	60	70	55	55
	L	25	40	55	65	65	55	53
8 (4-'63)	R		25	55	40	60		40
	L		40	55	75	70		57
9 (6-'63)	R		35	85	95	75		58
	L		55	85	85	85		75
10 (7-'63)	R	30	45	85	75	75		68
	L	35	60	90	85	85		78
11 (7-'63)	R		50	90	70			70
	L		50	70	70			63

SERIAL LANGUAGE SUMMARY

Age: Yr. 4 Mo. 3
MLR SCS MSCS
1 0 0
N agreed on: 12
N one-word: 12

Age: Yr. 4 Mo. 6
MLR SCS MSCS
1.72 4 .08
N agreed on: 50
N one-word: 28
Templin: 23
Peabody: 3-9

Age: Yr. 4 Mo. 9
MLR SCS MSCS
2.34 7 .14
N agreed on: 50
N one-word: 22

Age: Yr. 5 Mo. 0
MLR SCS MSCS
2.05 7 .18
N agreed on: 39
N one-word: 19
Templin: 23
Peabody: 4-6

SERIAL AUDIOGRAM (ASA)

SUBJECT: IJ

Test	Ear	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Average
1 (6-'61)	R		60	70	80			70
	L		30	40	40			37
2 (10-'61)	R		50	80	75			68
	L		40	65?	70			58
3 (1-'62)	R	30	35	55	60	65		50
	L	40	45	50	70	65		55
4 (4-'62)	R	50	70	90	75	80		78
	L	65	85	NR	100	NR		--
5 (6-'62)	R		Not	tested				
	L	55	65	90	80	90		
6 (8-'62)	R	40	60	80	75	75		72
	L	35	55	70	75	70		67

SERIAL LANGUAGE SUMMARY

Age: Yr. 4 Mo. 3

MLR	SCS	MSCS
1.06	0	0

N agreed on: 16
N one-word: 15
Templin: 7
Peabody: 2-3

Age: Yr. 4 Mo. 6

MLR	SCS	MSCS
1.3	0	0

N agreed on: 50
N one-word: 29

Age: Yr. 4 Mo. 9

MLR	SCS	MSCS
1.64	0	0

N agreed on: 50
N one-word: 34

Age: Yr. 5 Mo. 0

MLR	SCS	MSCS
2 4	0	0

N agreed on: 50
N one-word: 16
Templin: 31
Peabody: 2-4

SERIAL AUDIOGRAM (ASA)

SUBJECT: JK

				Hz				
Test	Ear	250	500	1000	2000	4000	8000	Average
1 (10-'59)	R		50	40	40			43
	L		50	40	50	60		47
2 (7-'60)	R		75	80	75	80		77
	L	65	60	70	70	60	75	67
3 (7-'61)	R		40	60	80			60
	L		20	75	80			58
4 (2-'62)	R	45	60	60	55	60		58
	L	55	65	65	60	60		63
5 (8-'62)	R	45	50	60	60	65	60	57
	L	45	70	75	60	65	NR	68
6 (2-'63)	R		60	70	55			62
	L		75	60	60			65
7 (3-'63)	R		60	70	55			62
	L		75	60	60			65

SERIAL LANGUAGE SUMMARY

Age: Yr. 3 Mo. 9

MLR	SCS	MSCS
1.57	3	.08

N agreed on: 43
N one-word: 24

Age: Yr. 4 Mo. 0

MLR	SCS	MSCS
2.54	19	.43

N agreed on: 44
N one-word: 20
Templin: 26
Peabody: 5-9

Age: Yr. 4 Mo. 3

MLR	SCS	MSCS
2.34	9	.21

N agreed on: 43
N one-word: 22

Age: Yr. 4 Mo. 6

MLR	SCS	MSCS
2.46	13	.26

N agreed on: 50
N one-word: 20
Templin: 49
Peabody: 3-6

Age: Yr. 4 Mo. 9

MLR	SCS	MSCS
2.1	11	.22

N agreed on: 50
N one-word: 23

Age: Yr. 5 Mo. 0

MLR	SCS	MSCS
2.2	10	.2

N agreed on: 50
N one-word: 22
Templin: 47
Ammons: 6-5

Age: Yr. 5 Mo. 3

MLR	SCS	MSCS
3.04	14	.28

N agreed on: 50
N one-word: 14

Age: Yr. 5 Mo. 6

MLR	SCS	MSCS
3.26	23	.46

N agreed on: 50
N one-word: 5

SERIAL AUDIOGRAM (ASA)

SUBJECT: KL

				Hz				
Test	Ear	250	500	1000	2000	4000	8000	Average
1 (6-'60)	R		50	60	60			57
	L			50				--
2 (8-'60)	R		60	65	60			62
	L		45	50				--
3 (2-'61)	R		55	70	75	70	70	70
	L		50	70	85	55		68
4 (8-'61)	R	40	65	60	70			65
	L	50	50	60	65			58
5 (2-'62)	R	40	45	50	45	70		47
	L	15	40	50	45	60		43
6 (8-'62)	R	35	50	55	70	60		58
	L	20	45	75	70	70		63

SERIAL LANGUAGE SUMMARY

Age: Yr. 3 Mo. 0

MLR	SCS	MSCS
1	0	0

N agreed on: 2
N one-word: 2

Age: Yr. 3 Mo. 6

MLR	SCS	MSCS
No responses		

Age: Yr. 4 Mo. 2

MLR	SCS	MSCS
1.52	5	.1

N agreed on: 48
N one-word: 36

Age: Yr. 4 Mo. 4

MLR	SCS	MSCS
1.96	12	.24

N agreed on: 49
N one-word: 24
Templin: 22
Peabody: 63 (IQ)

Age: Yr. 4 Mo. 9

MLR	SCS	MSCS
2.0	4	.08

N agreed on: 48
N one-word: 23

Age: Yr. 5 Mo. 0

MLR	SCS	MSCS
2.16	7	.14

N agreed on: 48
N one-word: 23
Templin: 31
Ammons: 6-5

SERIAL AUDIOGRAM (ASA)

SUBJECT: LM

Test	Ear	Hz 250	500	1000	2000	4000	8000	Average
1 (6-'61)	R		50	60	70	80		60
	L	40	50	55	60	70		55
2 (2-'62)	R	35	40	55	65	60		53
	L	30	40	60	70	65		57
3((8-'62)	R	30	40	60	65	50	65	55
	L	50	50	60	70	50	60	60
4 (2-'63)	R	30	50	60	60	65	70	57
	L	25	45	60	70	65	60	58
5 (6-'63)	R	50	70	90	90	100		83
	L	45	45	60	75	65		60
6 (7-'63)	R	55	55	65	65	60		62
	L	40	55	70	70	70		63
7 (6-'63)	R	50	50	65	65	60		60
	L	40	50	65	70	75		62
8 (2-'64)	R	30	50	60	70	60	55	60
	L	35	45	60	65	65	60	57

SERIAL LANGUAGE SUMMARY

Age: Yr. 3 Mo. 7

MLR	SCS	MSCS
1.95	7	.32

N agreed on: 22
N one-word: 9

Age: Yr. 3 Mo. 10

MLR	SCS	MSCS
1.78	19	.38

N agreed on: 50
N one-word: 19
Templin: --
Peabody: 2-9

Age: Yr. 4 Mo. 3

MLR	SCS	MSCS
2.68	7	.17

N agreed on: 41
N one-word: 7

Age: Yr. 4 Mo. 2

MLR	SCS	MSCS
2.84	16	.32

N agreed on: 50
N one-word: 12
Templin: 40
Peabody: 4

Age: Yr. 4 Mo. 6

MLR	SCS	MSCS
2.74	7	.14

N agreed on: 50
N one-word: 8

Age: Yr. 4 Mo. 9

MLR	SCS	MSCS
2.48	15	.3

N agreed on: 50
N one-word: 15
Templin: 37
Peabody: 4-9

Age: Yr. 5 Mo. 0

MLR	SCS	MSCS
3.4	15	.3

N agreed on: 50
N one-word: 10
Templin: 47
Ammons: 4-5

Age: Yr. 5 Mo. 3

MLR	SCS	MSCS
3.46	7	.14

N agreed on: 50
N one-word: 3

APPENDIX B*

Visual Perception of
Hearing Impaired and
Totally Hearing Children

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*Based upon a thesis by Carl Binnie, as part of the requirements for the Master of Arts degree at the University of Denver, 1963.

Midway through the present investigation, the question of visual perception of the acoustically impaired child was raised. This population has long been studied for their efficiency in various sensory modalities. Differences between the acoustically impaired and hearing subjects have been reported in a number of studies and generalizations have been made pertaining to the visual perceptual abilities of these groups (Blair, 1957; Furth, 1961; Myklebust & Brutten, 1953; O'Neill and Oyer, 1961; Stafford, 1962). This area of investigation resulted from Binnie's interest in the area of visual perception of the acoustically impaired and from his awareness of a series of studies designed to test Piaget's theoretical viewpoint of the visual perceptual development of hearing subjects (Elkind & Scott, 1962; Elkind & Koegler, and Go, 1963; and Elkind and Schneider, 1963).

According to Piaget (1958, from Elkind, Koegler, and Go, 1953), perception changes with age. The young child has limited perception in that these operations are "centered on dominant figures". As the child develops, his perceptual operations change with his ability to shift from one configuration to another. Piaget refers to this as "de-centering". Spontaneous shifts of perception occur in mid-childhood so that the older child should be capable of perceptions which are freed from the field effects of closure, form, and proximity.

Due to the obvious relationship between visual perception and lip reading, it was through worthwhile to assess the development of visual perceptual abilities in acoustically impaired subjects and to compare their responses to hearing subjects of corresponding age levels. In addition, this comparison might yield information on the theoretical question of the effects of hearing loss on the development of perceptual processes *per se*.

The purposes of this portion of the study were: (1) to investigate whether acoustically impaired children differed from the hearing children in certain aspects of visual perception, and (2) to test Piaget's theory of the perceptual development with the acoustically impaired in de-centering, part-whole, and diamond illusion perception.

It was not possible to conduct this phase of the study with the experimental and control groups used in the balance of this study, since limitations in age groupings and numbers of subjects were not sufficient for this purpose. As a result, Binnie utilized the two groups outlined on the following pages. It was possible, however, to administer the same test materials used by Binnie to older members of the experimental group of this study, and the results of these tests are presented in the individual subject's summary and his score compared with that for the totally hearing child on this task.

Since the test items utilized require the use of language in securing the appropriate response (Elkind & Scott, 1962; Elkind, Koegler, and Go, 1963; and Elkind and Schneider, 1963) certain modifications of the test procedure were necessary. With the subjects of this study, language facility could not be assumed and, therefore, every effort was made to encourage individual and characteristic responses, whether oral, written, or manual. The subjects were encouraged to verbalize and/or point, gesture, write and finger spell their responses to the pictures. Each subject's spontaneous selection of one of these methods of communication was recorded as his communication preference.

The theoretical background for this portion of the study was drawn from the following areas: (1) sensory compensation of the acoustically impaired, (2) visual perceptual ability of the acoustically impaired, (3) perceptual development of hearing children in centering, de-centering, figure-ground reversal, part-whole perception, and diamond illusion, and (4) the opposed theoretical viewpoints of the Gestalt phychologists and Piaget's developmental psychology as applied to perceptual development.

I. Sensory Compensation.

An assumption has existed for some time that humans with a deficiency in one sense compensate through over-development of remaining senses. It is further asserted that this compensatory action may well result in a more or less automatic improvement in the acuity of the other senses (Cruickshank, 1955).

Evidence for sensory compensation is difficult to obtain from the published research. Lowenfeld (in Cruickshank, 1955) indicated that many experiments to determine the differences in sensory acuteness of the blind and the seeing were done near the turn of the century by Wundt and James. The research discussed in the literature, however, has been meager and little information subjected to statistical analysis is presented. Specific discussion of the problem of sensory compensation has been found in Hayes (1941). Cruickshank (1955); Myklebust & Brutten (1953), and Blair (1957). Hayes reported several studies and autobiographical reports pertaining to the sensory abilities of the blind and the seeing. Hayes quoted Levy in the book Blindness and The Blind (1872) as saying: "the truth of this compensatory assumption has been more or less denied by those immediately occupied in the matters connected with the blind." Levy also reported that the adage of sensory compensation may be explained through the distribution of nervous energy, a certain amount of which is utilized in every action of the body. This being the case, he felt that a sighted man expended more energy through the eye than with the organs of any other sense. If the sense of sight were deficient the nervous energy usually exerted by it would be utilized by other senses. Hayes felt that this viewpoint was not scientific and was more on the order of armchair speculation. The idea of a distribution of nervous energy and perception, however, has recently been discussed by Solley and Murphy (1960) who stressed the importance of attention. According to these authors, it is impossible to perceive without attending and, further, attention is selective, integrative, and energetic. The authors also stated that the integrative aspect of attention makes it possible for the organism to attend to several things at once as when various component parts form a pattern, or when shifting from a whole to part, or from figure to ground. The act of attending was stated to employ nervous energy which is necessary for the act of perceiving. Solley and Murphy also discussed reports that energy needed for attention may come from various sources such as the environment, internal drive states, surplus or generalized energy and concluded that the surplus of energy is not as important as the fact that additional energy is being utilized in the process of structuring percepts.

Stern (1938) discussed the distribution of energy and felt that energy concentrated upon one particular object of attention seems to take away from other objects. Solley and Murphy stated that:

> "It is possible that individuals learn to deploy available energy in characteristic patterns. Thus, some people may come to invest their deployable energy in one sense modality of another. One man may learn to be attentative, i.e., deploy his energies to sounds, such as music, or speech, or bird songs; another may learn to

> invest energy in visual sources, such as art forms, or colors. As such learning takes place some of the free energy becomes bound or permanently cathected to specific sources of stimulation."

Shifting of attention has been discussed by Piaget (Elkind, Koegler, and Go, 1963, from Piaget, 1958) in his work on perceptual activity. He theorized that there is a progressive, developmental change in response to visual conditions. In the infant, according to Piaget, there is a centering on the dominant figure and this centering produces a fixation on dominant objects and figures. However, as the child develops, his attention also develops and he is able to employ a process called de-centering which is the ability to shift focus and attention of the visual conditions.

In addition to the distribution of nervous energy, another early assumption was that one sense may substitute qualitatively for another and thus make it possible to get visual impressions through the sense organs of touch. Whalen (1892) in Hayes (1941) referred to this as the vicariate of senses. Hayes did not accept this theory and reported that any ability to compensate may be explained by acquired sense perception, or by the training of one sense to take the place of another. In the case of a person with a sensory impairment unusual development of this sense is necessitated.

Seashore (1918) indicated that in his experiments, the blind did not possess any significant superiority to normals in sensitiveness to touch and hearing, although some of his blind subjects were noted for their wonderful performances through hearing and touch.

While much of the literature deals primarily with sensory compensation of the blind as compared to the seeing, some generalizations exist regarding the sensory abilities of the deaf. Ferrai (Hayes 1941) expressed the conviction that the strength of the sight of the deaf is not superior to that of hearing persons.

Blair (1957) compared deaf and hearing subjects on visual memory and hypothesized that the visual memory of children with normal hearing experience, and that a severe deprivation in one sensory avenue, such as hearing, might influence the effectiveness of another sensory avenue, such as vision. The author felt that these differences would not be in visual acutiy, but would be in the area of mental activity as stimulated by the act of seeing. His sample of 53 deaf subjects ranging in age from 7 years, 6 months to 12 years, 6 months and matched with hearing subjects on intelligence, age, and sex, were presented the Knox Cube Test, Memory for Designs, Object Location Test, and four Memory Span Tests. His results indicated that the deaf were significantly superior to the hearing in the Knox Cube Test and in the Memory for Design Test; the Object Location Test showed the deaf and hearing were not significantly different. The hearing subjects were significantly superior on the four Memory Span Tests. The total results indicated that the visual memory of the deaf and hearing subjects as tested in this study does differ and the direction of the differences does depend upon the type of memory task involved.

Myklebust & Brutten (1953) reported on the visual perception of deaf children and stated that the assumption that the deaf possess keen visual acuity and sharp powers of observation may have some merit in that it suggests that the total organism is affected by this sensory deficit and must utilize its remaining resources more effectively. The organism would then develop compensatory skills in order to meet the exigencies of the environment. This view then assumes that hearing is integrated with the rest of the sensory aspects of the organism and that the absence of hearing must of necessity involve a reorganization of the system.

Myklebust (1953) reported that deafness causes the individual to behave differently since the entire system functions in a qualitatively different manner; this shift in behavior is compensatory in nature. Deafness, then, according to Myklebust, causes the individual to see differently, and to use tactual, kinesthetic, and olfactory sensations differently; because of all these differences, he asserted that the deaf person perceives differently.

Myklebust also reported on the importance of intersensory perception, the assumption that much of what we see may well be interpreted on the basis of what we have heard. Thus, auditory perception assists us in interpreting and evaluating visual experience, Myklebust's studies (1953) with visual perception of deaf and hearing children have shown that the deaf child has more difficulty interpreting visual experience than does the hearing child.

The concept of inter-sensory perception is seen in research on lip reading in auditory training or the combination of these two methods in educating and/or rehabilitating the acoustically impaired. Myklebust (1953) reported that the perception of the acoustically impaired child is qualitatively different from that of the totally hearing child and that deaf children should be given special instruction in perception and trained to use all their other senses to supplement the visual sense on the assumption that this different perceptual experience is a basic problem in all of the deaf child's adjustment and behavior.

Some research dealing with the concept of intersensory perception has been advanced to investigate lip reading ability and its importance as an educational tool. As may be expected, there is widespread difference of opinion in regard to which sensory avenue should receive primary concentration; some feel that speech or language would be better learned if attention were concentrated on one sense modality at a time, to the exclusion of others. The opposite viewpoint is that mutual stimulation and reinforcement of the senses is most efficient and that the eye and ear working together perceive speech better than either one alone.

Lip reading is the perception of speech by concentration upon visual stimulation presented by the speaker's face and mouth. Lip reading differs from auditory speech perception in two aspects (McEachern and Rushford, 1958):

1. It makes use of a different sense modality and
2. It depends on distorted or incomplete stimulus materials.

Studies comparing lip reading abilities and auditory perception area listed as advantageous in determining to what extent these two sensory modes of speech perception are comparable. McEachern and Rushford (1958) measured the lip reading ability of 32 college students with and without auditory stimulation; the results indicated no differences in these two modes and it was concluded that either lip reading ability and listening are independent or there is some curvilinear relationship between them. The subjects used were total hearing subjects and the results may not hold for the acoustically impaired.

Stone's study (1957) was designed to determine how much speech could be understood when the subject could see but not hear the auditory stimulation. The three conditions controlled were facial exposure, facial expression, and lip mobility. The subjects were 256 college graduates who possessed no hearing or visual impairments. The results indicated that both lip mobility and facial expression had significant effects on lip reading, but facial exposure had little effect on scores on lip reading, either by itself or when combined with other variables examined. The interaction between facial expression and lip mobility was also found to be significant.

O'Neill and Oyer (1961), O'Neill (1951), and O'Neill and Davidson (1956) found no significant relationships between lip reading ability and visual skills; however, O'Neill and Oyer indicated that research is needed in the area of perceptual skills, memory span, and perceptual field.

II. Visual perceptual ability of normal and acoustically impaired children.

Research on the visual perceptual ability of the acoustically impaired has been conducted mainly by comparing their responses with those of hearing subjects and by determining what differences, if any, are present. The studies of the perceptual functioning of the acoustically impaired child have been considered important because of the relative significance of the nature of perceptual processes in general. The acoustically impaired subjects have been found to be superior in some tasks, but inferior on others. Blair (1957) found the deaf subjects to be superior to hearing subjects on visual tasks which did not involve mental integration or mental abstraction, and inferior on tasks which involved abstraction. Blair concluded that the tasks on which the deaf subjects did better were really visual perceptual tasks and could be considered infra-conceptual in that the subjects did not have to abstract mentally or form concepts regarding their choices of performance.

Furth (1961) studied visual paired-associates tasks of deaf and hearing children. The tasks involved the association of four simple colors and two toy animals. He used 180 deaf children and compared them with a control group of 180 hearing children. The results show that the performances of the corresponding deaf and hearing age groups differed significantly only at the 11 and 12 age year level. The hearing children for the ages 7-12 showed an improvement of age that was statistically significant, but the change in age of the deaf subjects was not statistically significant. In both the hearing and the deaf samples, the girls were consistently superior to the boys.

In overall performance, the hearing subjects surpassed the deaf subjects, but this superiority was attributed to the failure of the 11 and 12 year deaf subjects to match the performance of the hearing children. It was concluded that the findings of an equal memory performance of the younger deaf and hearing subjects would indicate that the young deaf child's ability for visual color memory is equal to that of the hearing child. If deafness caused some basic change in general perceptual ability, one could expect systematic changes at all age levels, but particularly during the early age.

In a study measuring the problem solving ability of deaf and hearing subjects through visual tasks, Stafford (1962) concluded that the hearing subjects solved a greater number of problems than did the deaf subjects, and that the deaf children required a greater number of trials per problem solved. It was also concluded that the differences in scores could be attributed to the necessity to abstract and to possible differences in symbol systems.

Various investigations have shown that the deaf children are inferior to hearing subjects in areas other than visual perception. For instance, the deaf have been found to have deficiencies in reasoning and abstraction (Olaron, 1953), social competence (Barker, 1946), and emotional maturity (Mykelbust, 1947). Mykelbust and Brutton (1953) reported that the residential school deaf children indicated a high incidence of subnormal vision.

In the area of visual perception, Heider (1940) conducted a series of experiments dealing with color sorting behavior. His subjects were required to select one hue from a group of hues and to match the one selected to an appropriate color. The results indicated that the deaf children selected colors over a wider range than did the hearing subjects and while the performance of the deaf subjects did not qualitatively differ from normal hearing subjects, the deaf subjects performance was similar to that of the young hearing children.

Myklebust and Brutten (1953) indicated that a study of the perceptual functioning of deaf children might reveal significant information regarding the nature of the perceptual processes. They proposed to investigate where the deaf children differed from normal hearing children in certain aspects of visual perception. Their study was conducted to determine whether disturbances in visual perception might be concomitant with severe hearing impairment from early life.

Fifty-five deaf subjects from a State school for the deaf were compared with 55 hearing subjects on the following test: The Marbleboard Test, The Goodenough Draw a Man Test, A Pattern Reproduction Test, A Figure Around Test, and a Perseveration Test.

The results of the investigation generally indicated that the deaf children demonstrated a marked inferiority to the hearing subjects. The authors concluded that "deafness causes an alteration in the normal response modes of the organism, and that this alteration includes certain arresting disruptions in visual perceptual organization".

Basic to any consideration of perception by the child are the opposing viewpoints of the Gestalt psychologists and those of Piaget. Both these viewpoints predict that there would be differences in figure-ground reversal as a function of age; Piaget predicts an increasing ability with age while Kohler and Wallach suggest that figure-ground reversal should decrease with age. Piaget's assertion stems from his position "that perceptual operations must develop first before reversal is possible" (Elkind and Scott); Kohler and Wallach's prediction came from the assumptions that (1) with age there is a certain amount of resistance called "permanent satiation" and, (2) figure-ground reversal takes place more rapidly in non-permanently satiated tissue (Elkind and Scott, 1962, p. 620).

Elkind and Scott (1962) tested these two opposing theories of perceptual development by presenting an original set of ambiguous pictures which contained both figure and ground. One hundred twenty-six children were selected for this study the subjects being representative samplings of nursery school, 1st grade, 2nd grade, 3rd grade, and 6th grade children. The ambiguous pictures contained various levels of figure-ground articulation. The three levels of articulation varied in the dominant figures; of the seven stimulus cards, two fell in the category of most articulation, three in the intermediate level of articulation, and two were the least articulated.

Each child was tested individually and was asked to respond according to what was seen. After the initial response of the first card, the examiner asked the subject if he saw anything else. Only the spontaneous responses were recorded.

These results indicated that the success in perceiving ambiguous figures varies significantly with age, level of articulation, and I.Q. This supported Piaget's theory that perceptual development should increase with age.

In another study, Elkind, Koegler, and Go (1963) investigated the de-centering of perception in a part-whole test. The investigators were interested in whether the de-centering of perception could be demonstrated in the development of part-whole perception when both parts and wholes have different and independent meanings. They were also interested in testing Piaget's theory of increasing perceptual ability with age.

The test items were taken from nursery schools children's books and contained easily recognized and familiar objects. Three questions were asked in this study: (1) is there a regular increase with age in the ability of children to perceive both parts and wholes? (2) with figures in which the field effects favor part perception, will parts be perceived earlier than wholes? (3) with figures containing parts and wholes which are familiar and easily identified will both parts and wholes be perceived by a majority of children (75%) during middle childhood?

The subjects were tested individually and responded according to what they perceived. After the child's first response he was asked if he saw anything else. Again, only his spontaneous responses were recorded. The results indicated a regular increase with age in the percentage of children who perceived both parts and wholes, children perceived parts more readily than they perceived wholes, and a majority of the nine year old subjects were able to make a part-whole integration.

The finding that there was a general increase with age in the ability of children to perceive both part and whole supported Piaget's de-centering position. In addition, the finding that 75% of the nine year old children were able to perceive both part and whole was in agreement with Piaget's theory of the development of visual perception. Elkind and Scott (1962) have shown that the eight year level seems to be the point of the most abrupt perceptual improvement.

In another study, Elkind and Schneider (1963) investigated Piaget's developmental theory of perception with a Diamond Illusion Test. It was reported that Koffka first described the diamond illusion as being absent in young children but becoming increasingly pronounced thereafter. According to Piaget's theory, however, it was felt that the diamond illusion would be most pronounced in the young child but would gradually disappear with increasing age.

Elkind and Schneider (1963) reported that "the diamond illusion arises from the subject's comparison of the diagnosis of the diamond with the sides of the square. Since the diagonals are both higher and wider than the sides of the square, the tendency is to judge the diamond as larger than the square. To the yound child, whose perception is centered, the form differences between the square and the diamond will dominate his attention and will appear to him as fixed and unalterable. The young child should compare the diagonals of the diamond with those the square and arrive at the conclusion that the diamond is the larger of the two. The purpose of the study was to provide a test of Piaget's theory by determining whether the diamond illusion does increase or decrease between the ages of six and ten."

The sampling included 130 children in the grade levels from one to five. Each child was tested individually and was asked if the two pictures were the same size. If the child indicated that one item looked larger than the other he was asked to point out the larger one. The results indicated a regular decrease with age in the perception of the diamond illusion. This finding supported Piaget's perceptual theory, but contradicted Koffa's view that the diamond illusion should be pronounced with age. The three studies by Elkind, et.al., offer interested accounts of the perceptual development of children. The perception of figure-ground reversal, part-whole and diamond illusion perception offered support to Piaget's theory which indicated an increasing perceptual ability with age. Elkind (1962) stated that these tests are important as they deal with the perceptual development of children over a wide age range and, because they have underlying theoretical considerations, the results of the investigation may allow for meaningful interpretations. It was suggested that research in this area would be valuable in comparing the perceptual abilities of normal children with those of retarded and limited hearing children.

PROCEDURE

I. Subjects

The subjects for this study were 47 children attending the Colorado State School for the Deaf and

Blind in Colorado Springs, Colorado and 33 children attending classes for the deaf and hard of hearing at Evans School in Denver, Colorado. All of the subjects were acoustically impaired to the extent of averaging 65db or more in the better ear for the frequencies of 500, 1000, and 2000 cps. The subjects from both Evans and the State School who were available for this investigation were formerly taught by means of the oral method of communication. Age, sex, I.Q., and school data for the subjects are given in Table 1.

As shown in Table 1, there were ten children at each age level with about an equal number of boys and girls at each level. A child whose age was at least 6.0 years but not yet 7.0 years at the time of testing was placed in the six year group; the same criterion applied at each of the other age groups. This procedure followed that established for these test materials is the studies by Elkind, cited above.

I.Q. scores were obtained from available scores at the schools and included five different tests

(Nebraska Test of Learning Aptitude, Ontario, Chicago Non-Verbal, Stanford Binet, and W.I.S.C. Performance) so that the mean I.Q.'s shown on Table 1 should be regarded as only suggested measures in as much as scores for the different tests were included in the tabulation. As a result, mental age scores were computed from chronological ages and I.Q. scores because they were considered to be more meaningful estimates of the child's mental functioning and could be interpreted in terms of age levels for the subjects.

II. Testing Procedure

The three tests used in this investigation were original tests designed by Elkind _et_._al_. (Elkind and Scott, 1962; Elkind, Koegler, and Go, 1963; and Elkind and Schneider, 1963). The tests are called the Picture Integration Test, Diamond Illusion, and Picture Ambiguity Test. Reproductions of these three tests are given in Figures 1,2, and 3.

The procedures for administering the tests were the same as used for subjects of the previous studies. The procedure followed in this investigation is presented on the following page.

Table 1

Distribution of Subjects by School, Sex, Age, and IQ

Age Level	Colorado Springs				Evans			
	N	Boys	Girls	X IQ	N	Boys	Girls	X IQ
6.0-6.11	4	2	2	107.7	6	3	3	128.2
7.0-7.11	3	1	2	115.7	7	5	2	106.8
8.0-8.11	4	2	2	99.0	6	4	2	103.5
9.0-9.11	9	5	4	87.5	1	0	1	118.0
10.0-10.11	5	2	3	106.8	5	2	3	107.6
11.0-11.11	8	4	4	99.8	2	1	1	100.5
12.0-12.11	6	2	4	93.6	4	3	1	101.7
13.0-13.11	8	5	3	91.2	2	2	0	115.5
Group	47	23	24	97.4	33	20	13	110.1

Table 1-A

Distribution of Subjects by School, Sex, Age, and IQ

Age Level	Total			
	N	Boys	Girls	X IQ
6.0-6.11	10	5	5	119.0
7.0-7.11	10	6	4	109.5
8.0-8.11	10	6	4	101.7
9.0-9.11	10	5	5	90.6
10.0-10.11	10	4	6	107.2
11.0-11.11	10	5	5	100.0
12.0-12.11	10	5	5	96.9
13.0-13.11	10	7	3	96.1
Group	80	43	37	102.6

Picture Integration Test

Each child was tested individually. The cards were shown one at a time in the order of the card value. Each card was numbered and the cards were then presented in order from card one through card seven. The child was instructed, "I am going to show you some pictures one at a time. I want you to look at them and tell me what you see, what they look like to you." After the child's response to the first card he was asked (if he had not seen either the parts or whole), "Do you see anything else?" Thereafter, no further questions, other than to clarify a response, or ask if the spontaneous responses were recorded.

The child was given a W for every whole response, a D for every part response (regardless of the number of parts mentioned) and a W+D for every whole and part response. Each part response was given a score of 1, each whole response was given a score of 2, and each part and whole response was given a score of 3. Elkind, Koegler, and Go (1963) reported that "since nursery school children saw parts and not wholes we assumed wholes were more difficult to see and so gave them a higher numerical score." For the seven cards, there was a total possible score of 21 points.

Diamond Illusion Test

Each child was tested individually and was asked, "Are these two pictures the same size?" No reference was made to the forms. If the child replied that one of the pictures was larger than the other he was asked to point out the larger one to the examiner.

A score of 1 was given for each correct size judgment and all other responses were given a score of 0. Only responses to the test cards were scored so that there was a possible score of six on the Diamond Illusion Test.

Verbal understanding on the Diamond Illusion Test was essential for meaningful results, and thus Elkind and Schneider (1963) imposed several controls to insure such understanding. The first control was the inclusion of sample cards in which the size comparison did not involve any rotation of form. In these control cards the perception of Diamond Illusion was not required, but the subject were required to select one card as being larger than the other or to select them as being the same size. Correct selection of these control cards implied understanding of the task at hand.

Picture Ambiguity Test

Each child was tested individually. The cards, numbered from one through seven were shown one at a time in the order of the card value. The child was instructed, "I am going to show you some pictures one at a time. I want you to look at them and tell me what you see." After the child's response to the first card he was asked, "Do you see anything else?" Thereafter, no further questions were asked, and only spontaneous responses were recorded.

The child was given one point for each complete figure seen and one-half point for each incomplete perceived figure. No extra points were gained when two similar contents were given for exactly the same area. For example, the child who saw a butterfly and a bird in the same area was given only one point.

The same initial instructions were given to all subjects and the responses were recorded. The same method of procedure followed for all subjects. The Picture Integration Test was administered first, then the Diamond Illusion Test, followed by the Picture Association Test. The same order of presentation within each test was followed for each subject.

Since some acoustically impaired subjects exhibited some degree of difficulty in fully understanding the instructions of the three tests, similar instructions were used to supplement oral instructions.

For example, if the subjects did not seem to understand the initial set of instructions which were presented orally, the child was shown some written instructions which contained such sentences as "What do you see in the picture?", "What is this?", "Tell me what you see.", etc.

The meaningful grouping of the subjects according to their communication preference seemed advisable after they understood the instructions and began responding. The grouping of communication preference developed from the spontaneous responses of the subjects. Some subjects reponded by use of oral communication while other did merit in that it suggests that the total organism is affected by this sensory deficit and must utilize its remaining resources more effectively. The organism would then develop compensatory skills in order to meet the exigencies of the environment. This view then assumes that hearing is integrated with the rest of the sensory aspects of the organism and that the absence of hearing must of necessity involve a reorganization of the system.

Myklebust (1953) reported that deafness causes the individual to behave differently since the entire system functions in a qualitatively different manner; this shift in behavior is compensatory in nature. Deafness, then, according to Myklebust, causes the individual to see differently, and to use tactual, kinesthetic, and olfactory sensations differently; because of all these differences he asserted that the deaf person perceives differently.

Myklebust also reported on the importance of intersensory perception, the assumption that much of what we see may well be interpreted on the basis of what we have heard. Thus, auditory perception assists us in interpreting and evaluating visual experience, Myklebust's studies (1953) with visual perception of deaf and hearing children have shown that the deaf child has more difficulty interpreting visual experience than does the hearing child.

RESULTS

Statistical analysis. The results from each test were analyzed by means of a simple analysis of variance with age as the variable.

P.I.T.

Age: The F for age was 3.2 and was significant at the .05 level. Inspection of the mean scores for each age group indicated a regular increase with age in successful part whole perception. The mean score at age six was 8.9 and increased to 13.6 at age 12 with a drop to 12.8 at age 13.

Comparison with normals: Comparison of the P.I.T scores with normative data for totally hearing subjects indicated that the acoustically impaired subjects were several years behind the hearing subjects as shown in Table 2.

Controls: Control tests showed that there was no difference between limited hearing boys and girls with respect to their P.I.T performance; that P.I.T. performance was positively related to M.A. but unrelated to degree of hearing loss. A Chi Square test of communication preference revealed that those youngsters who chose to communicate orally were significantly better at part whole perception than were children who chose to communicate by gesture or writing.

D.I.T.

Age: The F for age on the D.I.T. was not significant and inspection of the mean scores for each group revealed no significant increase with age in these measures.

Comparison with normals: In contrast to the hearing youngsters, the limited hearing children did not improve with age in overcoming the effects of the diamond illusion. Indeed, the six year old limited hearing youngsters were comparable to the 12 year old children with respect to their performance on this task.

Controls: Control tests showed no difference between limited hearing boys and girls with respect to their performance on the D.I.T. Likewise, none of the Chi Square comparisons for mental age, communication preference or severity of hearing loss differentiated within the group.

P.A.T.

Age: The F for age on the P.A.T. was 5.3 and was significant at the .01 level of significance. Inspection of the mean scores revealed that these increased fairly regularly with age.

Table 2

Mean Scores for Picture Ambiguity Test by Age Levels of Acoustically Impaired and Hearing Subjects

Hearing Subjects		Acoustically Impaired	
Age Levels	X	Age Levels	X -
			6.
6	7.55	6	6.0
7	8.25	7	7.4
8	12.32	8	7.4
9	13.12	9	7.4
10	14.32	10	8.7
11	13.65	11	7.5
12	-	12	10.1
13	-	13	8.9
Group	11.53	Group	7.9

Comparison with normals: The performance of the acoustically handicapped children on the P.A.T. indicated a general retardation in perceptual development as compared with hearing youngsters. The difference is shown graphically in Table 2. In general the degree of retardation increases with age.

Controls: A Chi Square test for sex differences in P.A.T. performance was non-significant. There was, however, a significant relation between M.A. and P.A.T. performance as indicated by a Chi Square of 5.0 (p.05). There was also a tendency for youngsters preferring oral communication to do better on the P.A.T. than those who preferred non-oral modes of communication. The Chi Square for the oral vs. non-oral groups was 6.80 (p.05). There was no relation, however, between degree of hearing loss and performance on the P.A.T.

DISCUSSION

The results of the present study have shown; that a) with the exception of the illusion test,

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perceptual performance of hearing handicapped children improves with age, and that b) at all age levels the limited hearing youngsters are retarded on perceptual de-centration tasks in comparison with hearing subjects. In addition control tests revealed no sex differences with respect to performance on de-centration tasks and also that severity of hearing loss was not related to success or failure on such tasks. On the other hand, successful de-centration performance was related to mental age and to the communication preferences of the subject. In the remainer of this paper we will discuss these findings from the standpoint of Piaget's developmental theory of perception.

Age improvement, and retardation in perceptual de-centration.

In Piaget's theory, perceptual growth is the joint product of maturation and experience so that in this sense it is both a nature and a nurture theory. As has been demonstrated in another investigation

(Elkind, Koegler, and Go, 1962) the influence of maturation can be shown by the fact that younger children require more training to reach a lower level of achievement than is true for older youngsters. On the other hand the influence of experience can be shown by the fact that children at all age levels improve with perceptual training although the relative differences between the age groups remains the same.

With respect to limited hearing subjects the same holds true. The gradual increase in perceptual ability with age is thus attributable to both maturation and experience. On the other hand, the experience of the limited hearing child is in many ways much less rich than that of hearing youngsters. Since the influence of maturation and experience is a joint one any limitation of experience is bound to affect maturation as well. Consequently we would expect acoustically impaired youngsters to lag behind hearing youngsters on perceptual tasks, especially those which require abilities (such as perceptual de-centration) over the entire elementary school age. The findings of the present study are thus in keeping with Piaget's theory of perceptual development.

It remains to take up the problem of those tasks wherein limited hearing subjects are equal or superior to hearing children, and the problem of the complete failure of the limited hearing youngsters on the diamond illusion task. With respect to the first problem, it would seem reasonable to assume that those tasks on which hearing children do equally well or better than hearing children, require abilities that mature relatively early and which thus minimize the hearing child's experimental handicap. Probably hearing is less important to early perceptual development when verbal abililities are undeveloped than it is when verbal input is a major source of mental growth. With respect to the diamond illusion, it may well be that this task presents conceptual difficulties (same "size") in addition to perceptual ones and that it was the conceptual rather than the perceptual handicap that limited the acoustically impaired youngsters' performance on this test.

In general the implication of these findings is that an analysis of the mental processes required by particular tests is imperative if we fully understand and predict the performance of limited hearing subjects on psychological tests.

Perceptual de-centration and mental age. In studies with normals perceptual de-centering has been found to be related to mental age or to general intelligence. It might thus be argued that all we have really done is add another test of intelligence and that all the talk about de-centration is so much fluff. Such an objection would be valid if there was general agreement as to the nature of intelligence as measured by mental tests. Yet as everyone knows this is far from the case. Quite the contrary is true and psychologists still define intelligence as what the tests measure. The advantage of the de-centration notion is that it attempts to specify some of the mental processes required by IQ tests. We have, therefore, no quarrel with those who argue that de-centration tests measure intelligence and our position is merely that we have attempted to specify at least one of the mental processes generally included in this term.

With respect to the limited hearing child, to the extent that he is retarded in perceptual de-centration this says nothing as to his overall intelligence. All we have argued here is that the limited hearing child is several years behind the hearing child in his ability to de-center his perception.

Perceptual de-centration and communication preference: The finding that, with the exception of performance on the diamond illusion, communication preference correlates with perceptual de-centering ability fits nicely with the arguements advanced thus far. It seems likely that those children who respond orally have tried to make use of their auditory experience to a greater extent than have those children who prefer to write or gesture. Since, as we have argued above, perceptual growth depends upon both experience and maturation, the oral preference person is the more experienced person and thus would have developed further than the non-oral preference person. Put differently, the better perceptual performance of the oral preference person is a by-product of his effort to gain a richer input of sensory experience. The richer experience benefits not only his speech but also the development of his entire realm of mental capacities. If this interpretation is correct it would be strong evidence for employing the unisensory approach to teaching limited hearing children.

SUMMARY

The purposes of this study were (1) to determine whether or not acoustically impaired children differed from hearing children in certain aspects of visual perception and, (2) to test Piaget's theory of perceptual development with acoustically imapired children in de-centering, part-whole, and diamond illusion perception.

The hypothesis underlying the study were (1) age changes in the perception of acoustically impaired children would support Piaget's theory of perceptual development, (2) there would be no differences between the visual perceptual development of the acoustically impaired subjects and totally hearing subjects, (3) there would be no differences between visual perceptual development of acoustically impaired boys and girls, and (4) there would be no correlation between extent of hearing loss and visual perceptual ability.

Three tests of visual perception, standardized on a normal hearing population, were used: the Picture Integration Test, Diamond Illusion, and Picture Ambiguity Test.

Eighty acoustically impaired subjects were selected for the investigation with ten subjects in each of eight age levels (6 through 13).

Analysis of variance, the Median Test, and product-moment correlation were used to determine the significance of the hypotheses being investigated; the results of the tests on these subjects were also compared with normative data for normal hearing subjects. The Median

Test was also used to determine relationships between communication preference (writing, oral, and manual), IQ, and hearing level and the P.I.T., P.A.T.,and D.T.

The following conclusions were drawn on the basis of the results of the investigation:

Piaget's theory of perceptual development was supported by the P.I.T. and P.A.T. results; the D.I. did not offer support to the theory of increasing perceptual ability with age.

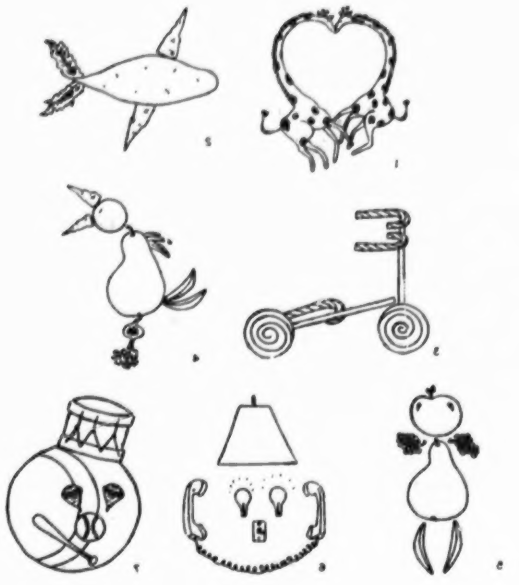
The acoustically impaired subjects were inferior to the hearing subjects on all three perceived more parts and made fewer part-whole integrations than the totally hearing subjects were able to achieve a 75% level of part-whole integration as was reported for the nine-year old hearing subjects. The level of perceptual change for the acoustically impaired subjects on the P.I.T. occurred at age twelve, which placed them approximately three years behind the hearing subjects in visual perceptual development.

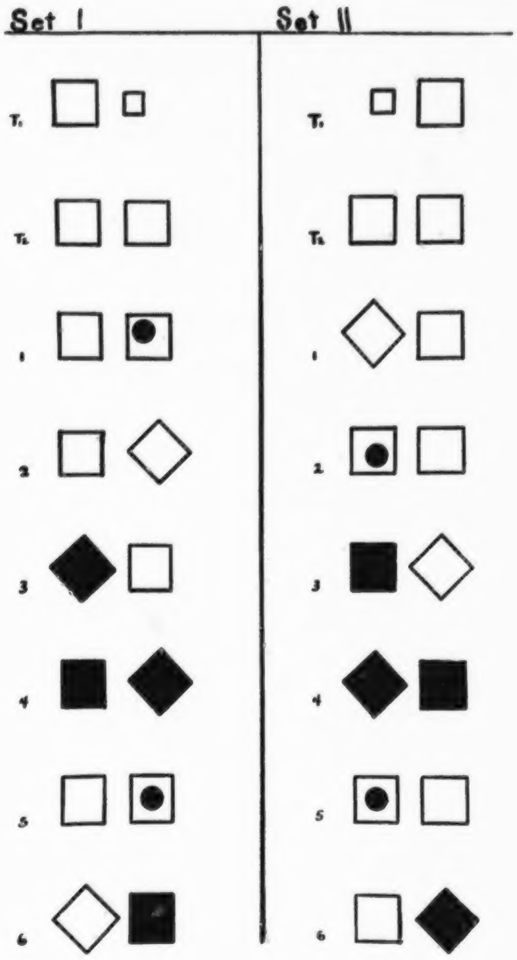
The overall average of the acoustically impaired subjects on the D.I. was below the first grade (age six) average of the hearing subjects. At only three age levels (7,8, and 13) did the acoustically impaired subjects obtain a score which approximated the first grade level of the hearing subjects.

The overall average score for the acoustically impaired subjects on the P.A.T. placed them in the first grade (age six) level of the hearing subjects; none of the acoustically impaired subjects obtained scores at or above the grade three (age eight) level of the hearing subjects.

The results of the investigation indicated no differences between acoustically impaired boys and girls in visual perceptual development.

The oral subjects performed significantly better than the non-oral (manual and writing) subjects on the P.I.T. and P.A.T. although no differences in mental age or hearing level were indicated. The oral subjects were found to have incurred their hearing losses later than the non-oral subjects.

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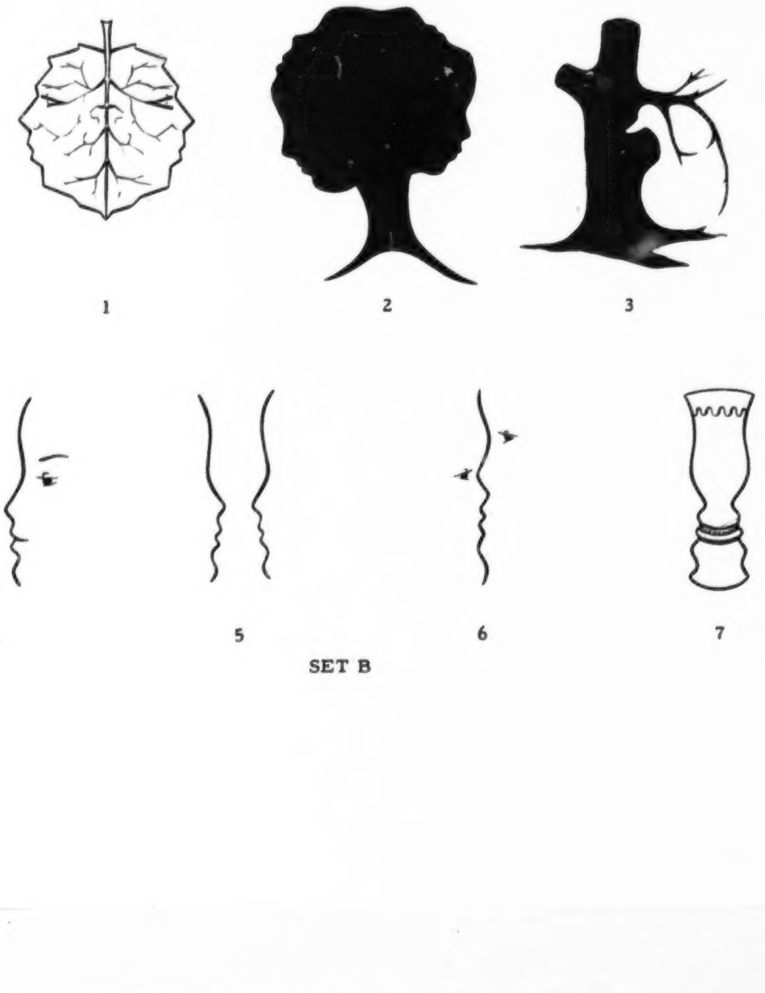

SET B

APPENDIX C

Lipman Picture Discrimination Test [1]

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[1] Developed by Mrs. Beverly S. Lipman during the course of the present investigation. Evaluation not completed at the termination of the study.

This test was designed specifically for use with hard of hearing children. An attempt was made to use easiest pictures possible so that hearing for speech and not vocabulary would be under examination. (Only those pictures were used which were recognized most frequently by 24 normal children below 3 years of age.) Some of the words chosen are easier to discriminate in the context in which they are presented to the child and some are more difficult--the test does seem to be an effective tool in showing differences among hard of hearing children in speech discrimination ability.

Of the five pictures on a page, two have the same vowel, are both one syllable and differ in consonants only. The third picture on the page is a two-syllable word with the stressed vowel the same as the vowel in the two words above. The fourth picture is a "confusable" vowel in relation to the vowel above (same in length and tongue height as the main vowel). The fifth picture has a vowel different in both length and tongue height from the main vowel. The pictures are arranged randomly on the page.

The child's task is to select the appropriate picture from those presented to him on any page to match the word he (thinks he) hears. After the child is given the test by listening alone he is given the words he missed with both hearing and lip reading to determine which words he cannot discriminate and which he does not know.

INSTRUCTIONS

1. Give "screening test": ask child to locate parts of the face from boy picture by listening alone. If he can't do this, there is no point in giving him the test.

2. Test is to be given a specified intensity above SRT-usually 30 db. The tape-recorded stimulus list is preferred.

3. Give one stimulus word on a page, flipping pages after each stimulus - whether child responds or not.

4. For investigation of finer discrimination, after the word "pie" on card #13 is given, turn back to card #11 and show this to child along with the picutres on back of these pictures in his response.

5. Mark on a score sheet the picture the child misses. After running the test, give him the words he missed with speech-reading plus voice to separate those he doesn't know from those he cannot distinguish by hearing alone.

	2 Syllable	Different	Similar	Same Vowel	
				Low	High
1.	t.v.________	bed________	spoon______	tree______	feet______
2.	kitty________	glass______	book______	pig______	fish______
3.	pencil______	key________	truck_____	bread_____	dress______
4.	apple________	pin________	dog_______	man_______	hat________
5.	balloon______	bell_______	teeth_____	moon______	shoe_______
6.	cookies______	hand_______	milk______	book______	foot_______
7.	doggy________	swing______	pants_____	ball______	frog_______
8.	button_______	tree_______	leg_______	gun_______	cup________
9.	baby_________	brush______	eye_______	train_____	cake_______
10.	flower_______	pig________	boat______	mouse_____	cow________
11.	water________	duck_______	cat_______	doll______	clocks_____
12.	snowman______	bus________	cow_______	boat______	soap_______
13.	ice cream____	egg________	house_____	knife_____	pie________
Score:	__________	__________	__________	__________	__________

On card 11, find the:

doll______________

blocks____________

socks_____________

clocks____________

box_______________

On card 12, find the:

boat______________

coat________________

comb______________

bone______________

phone_____________

soap______________

toe_______________

On card 13, find the:

eye_____________

pipe____________

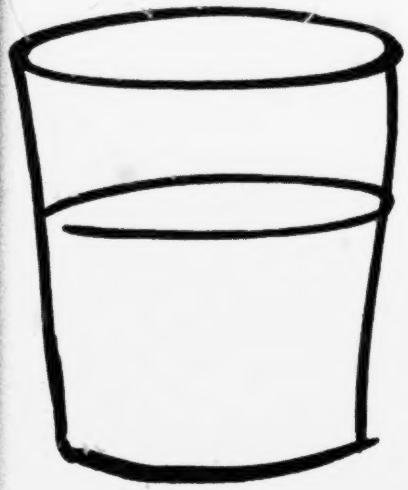
knife___________

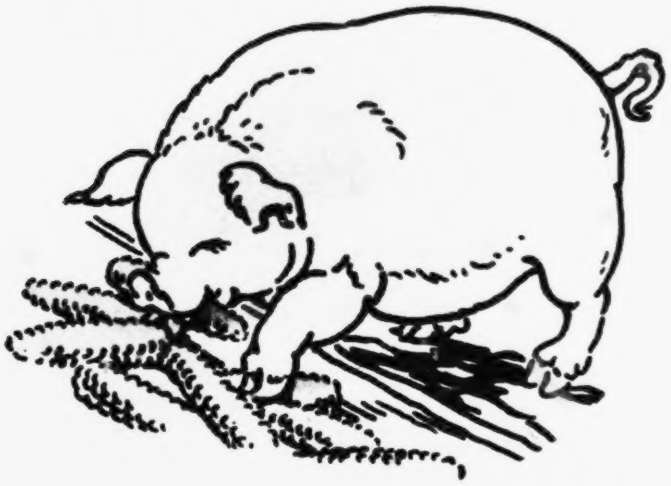
light___________

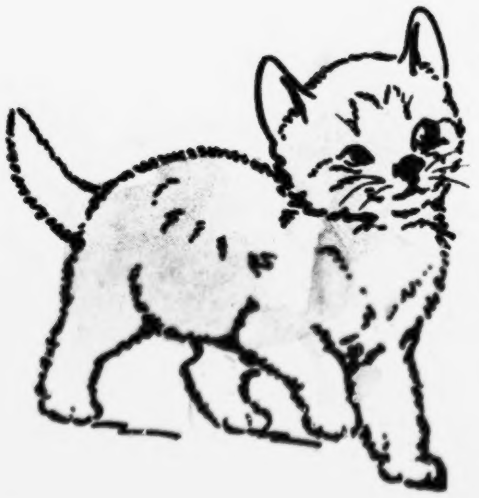
slide___________

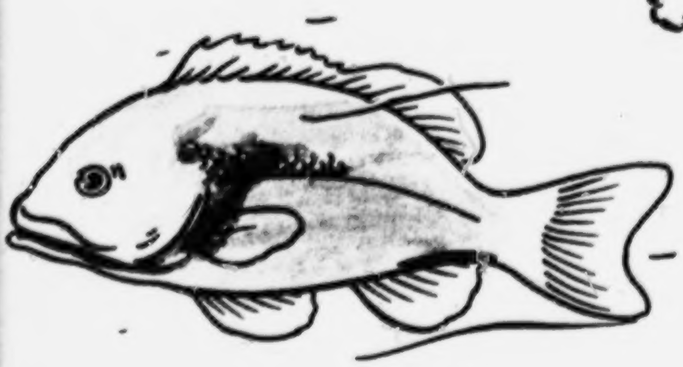
pie_____________

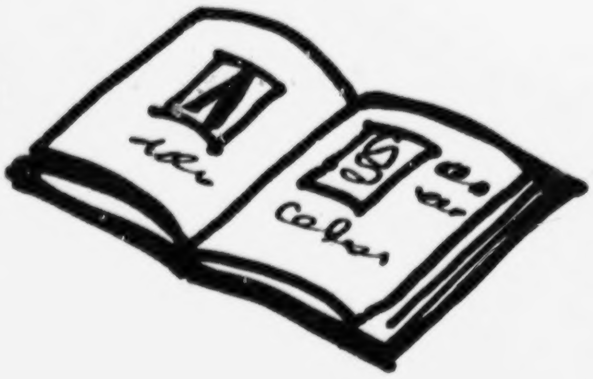
bike____________

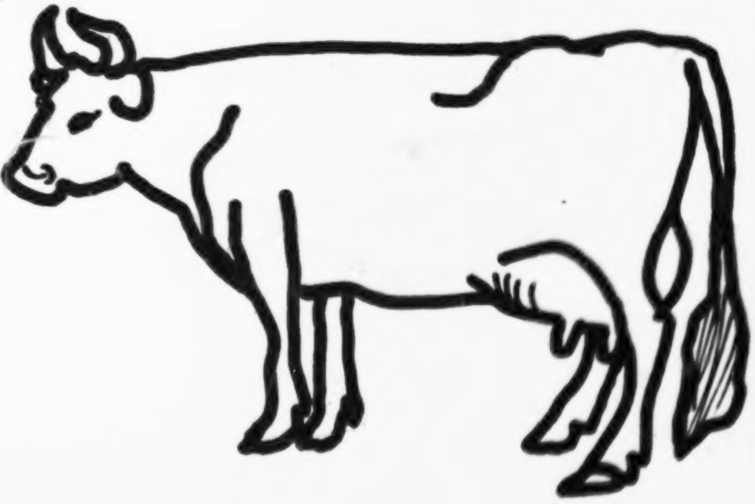


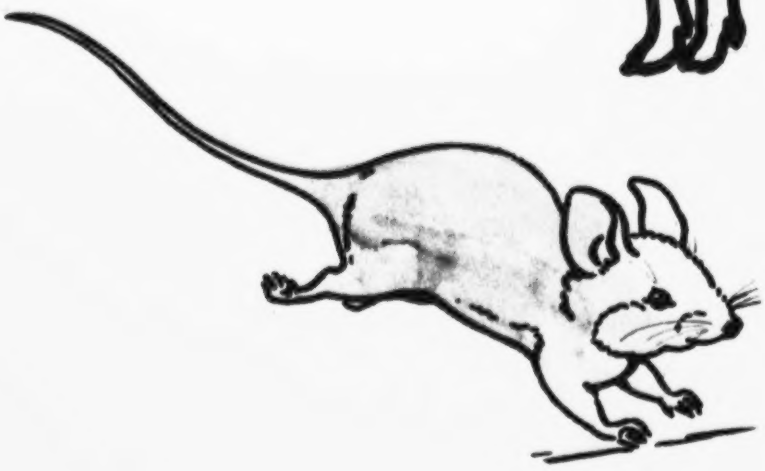


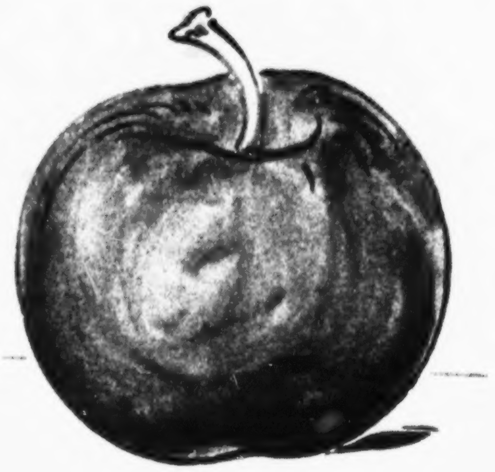


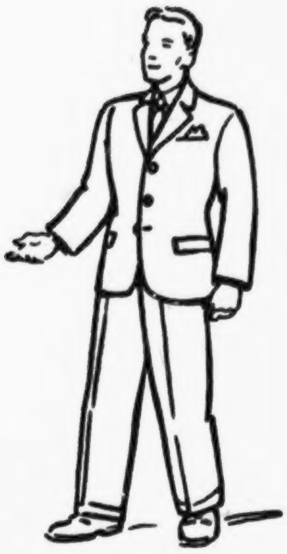


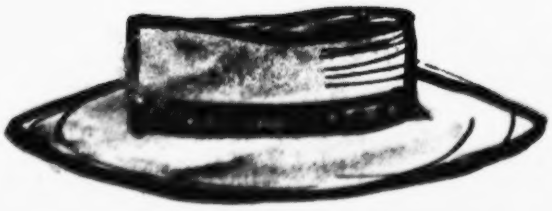


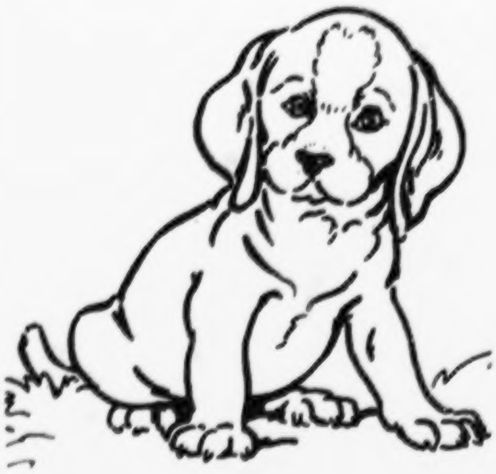


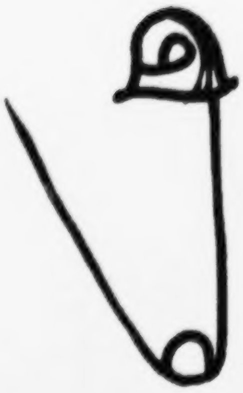


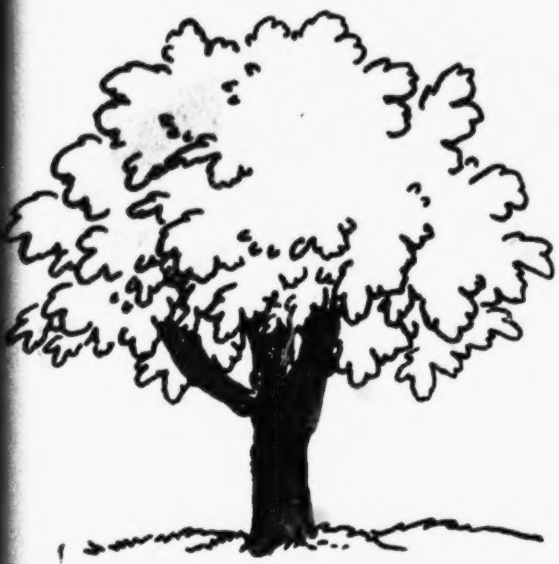


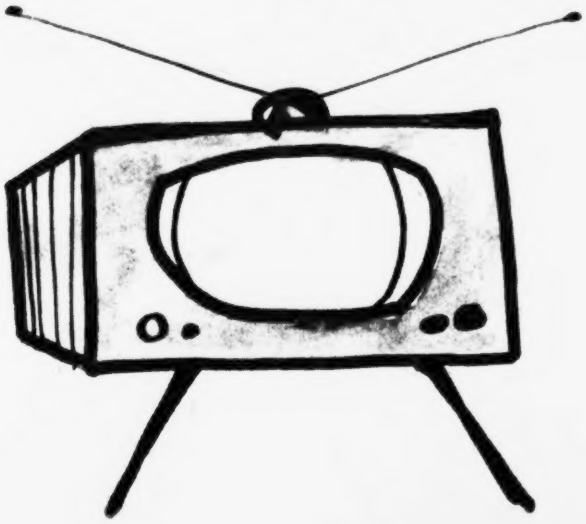


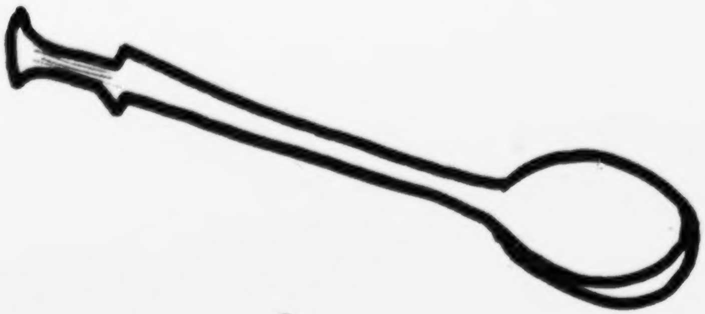


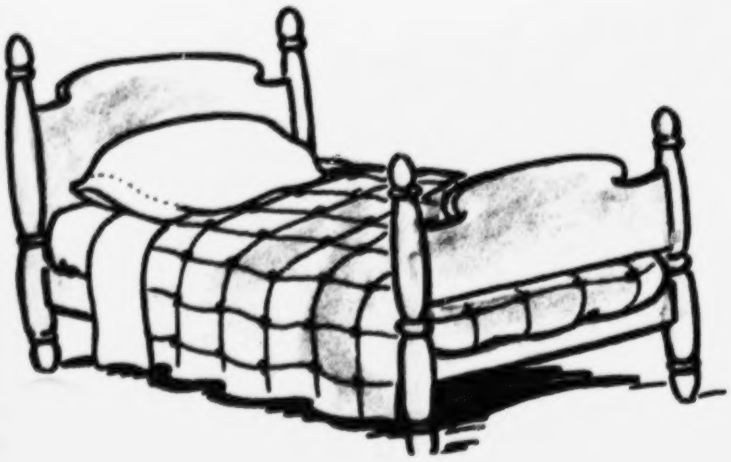


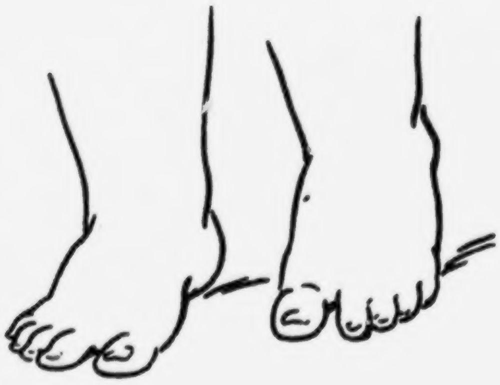


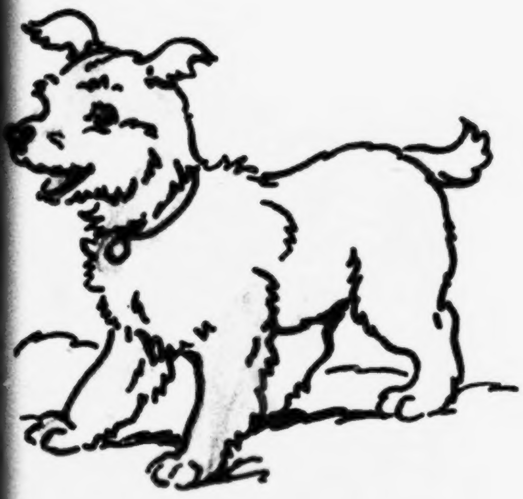


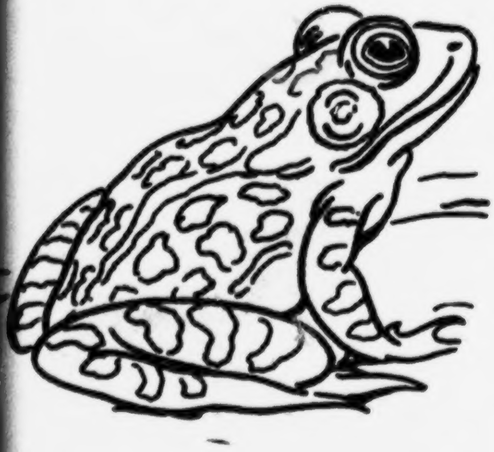


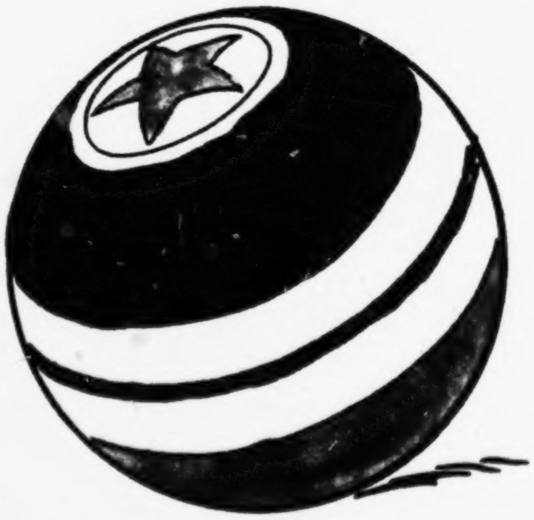


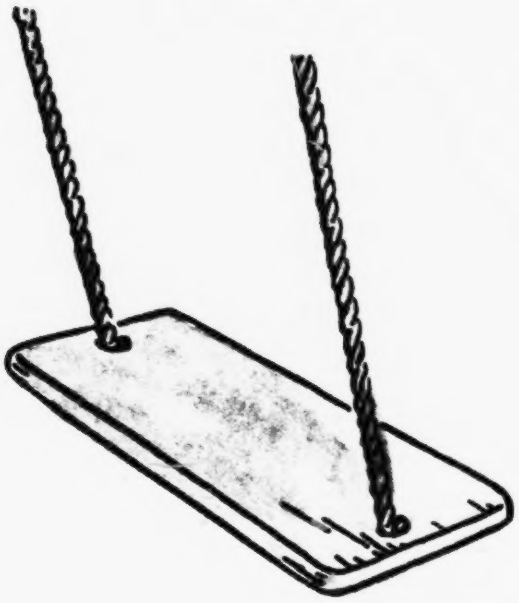


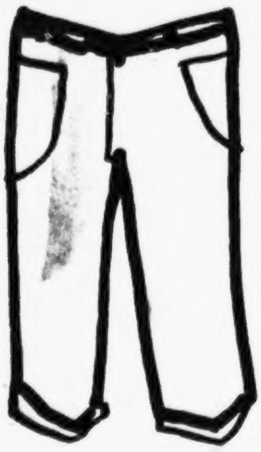


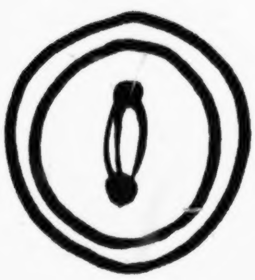


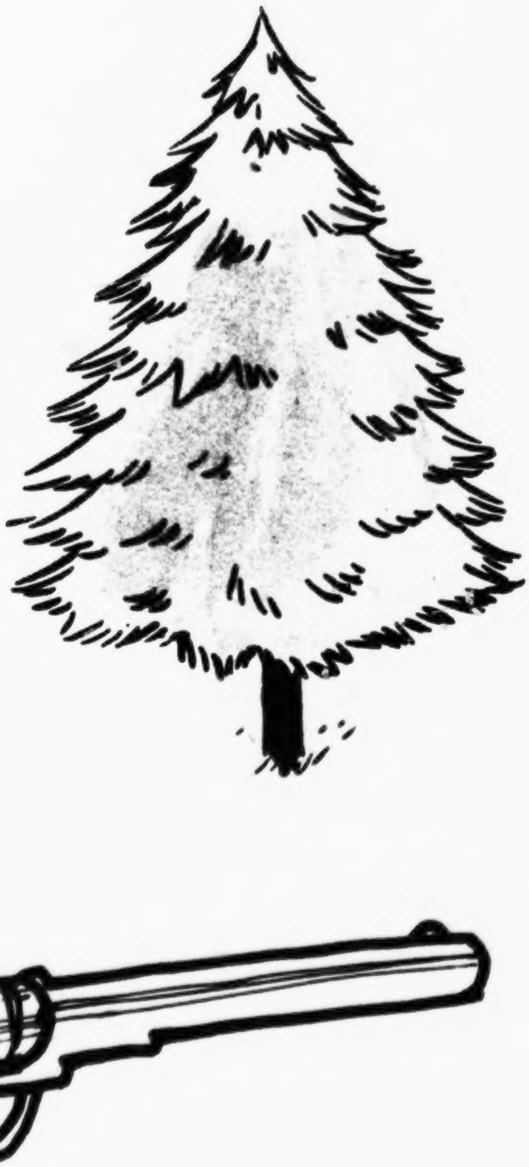


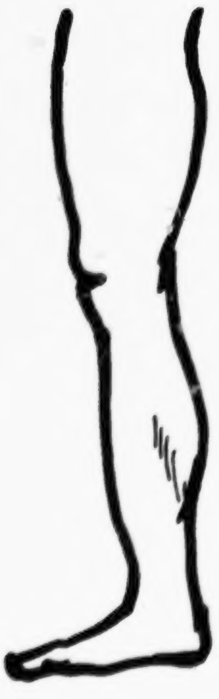


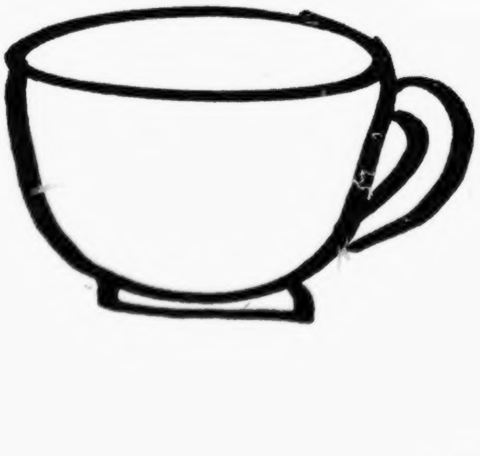


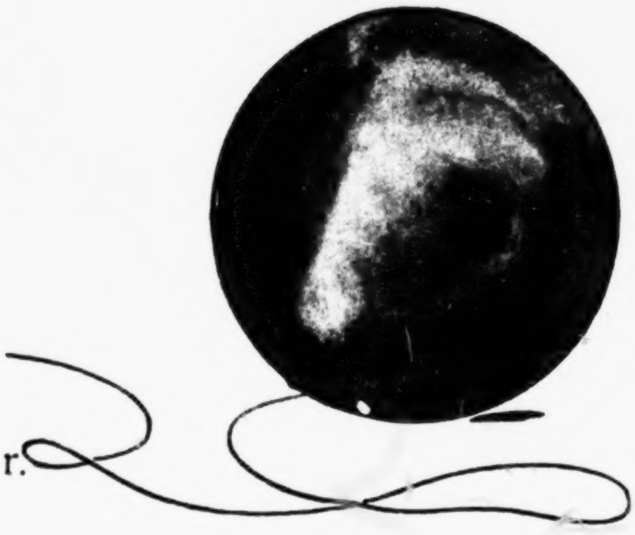












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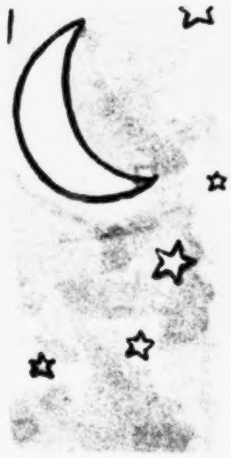

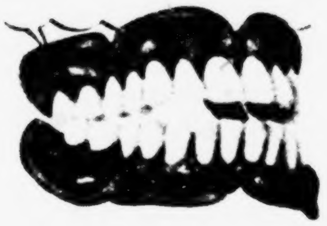

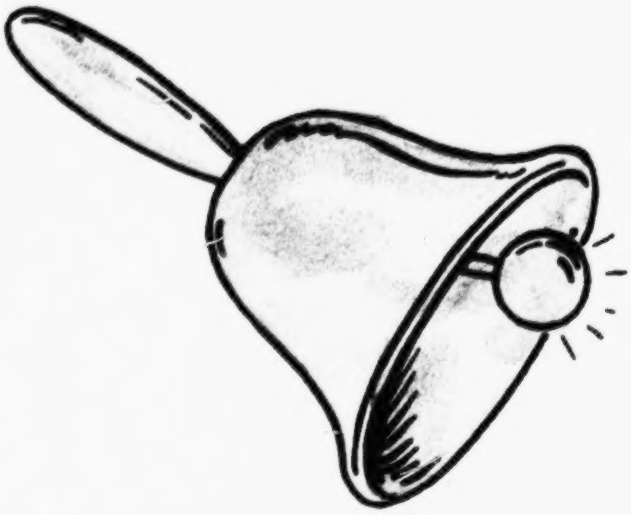

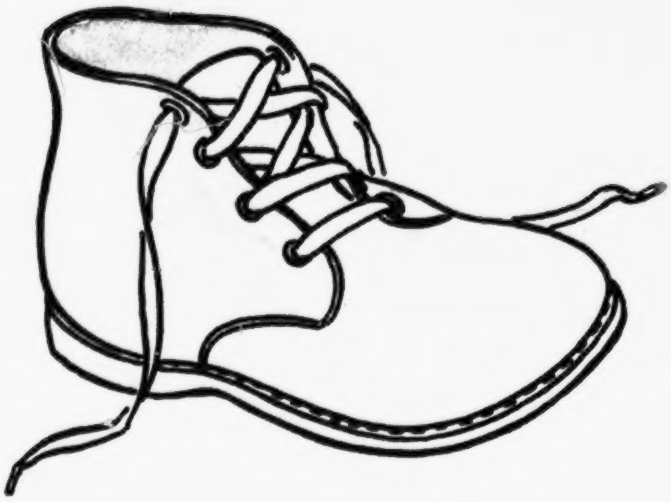

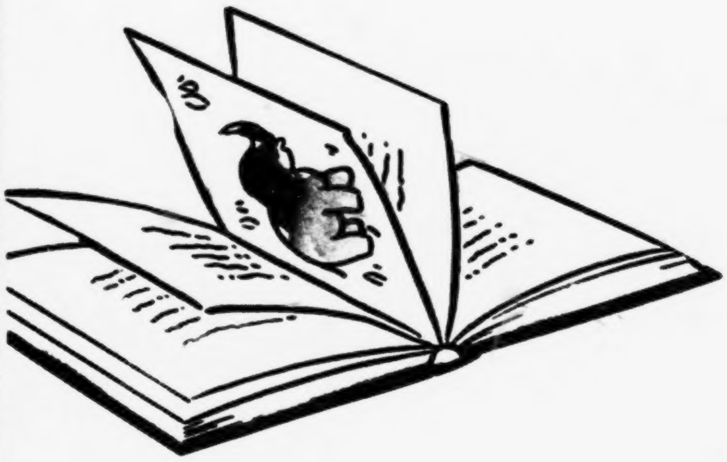

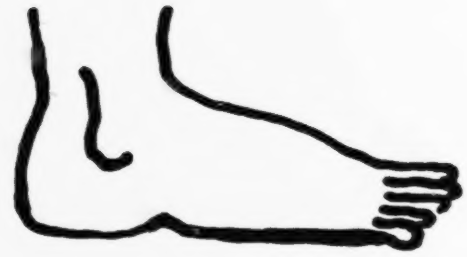

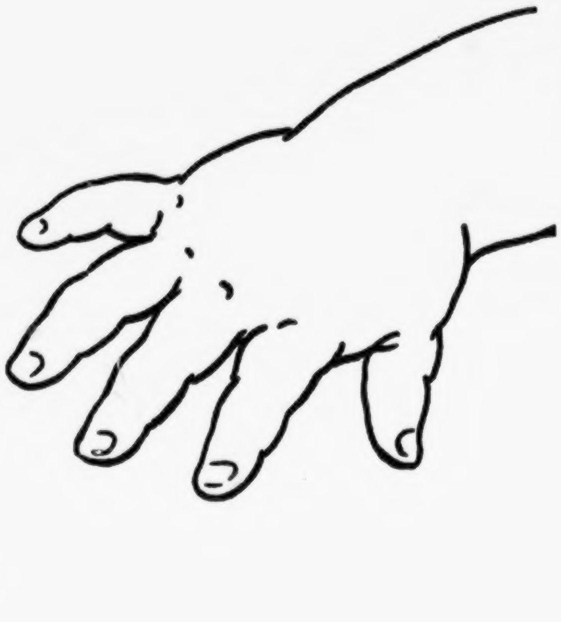

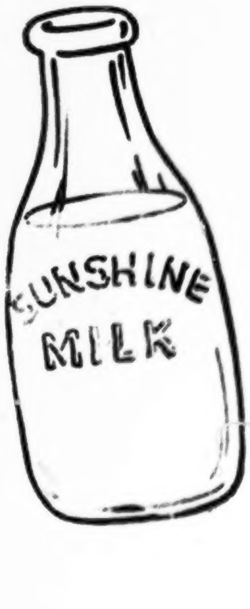
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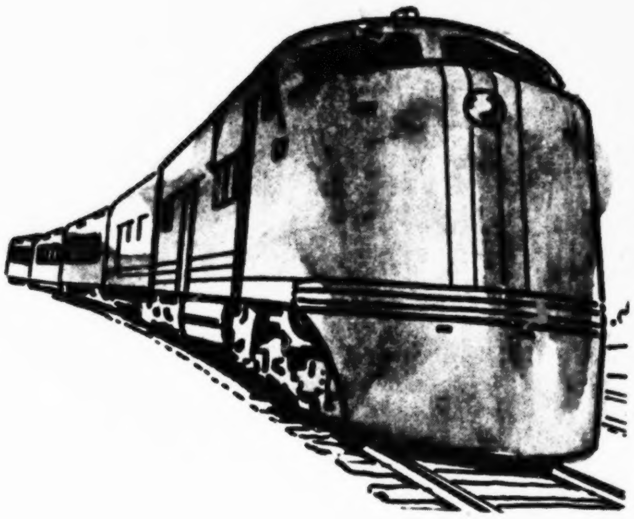

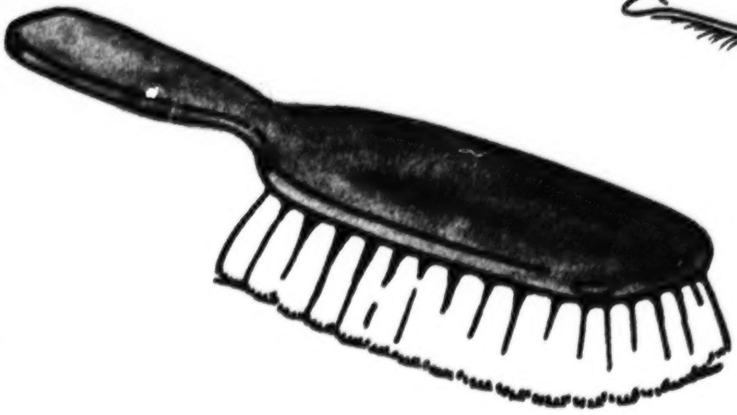

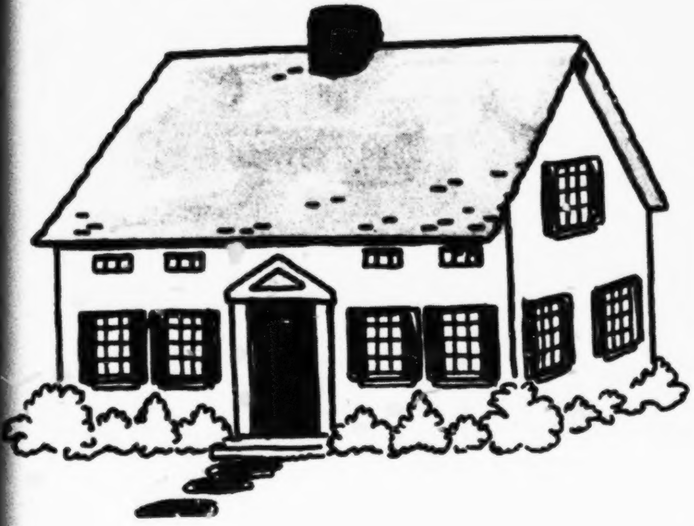

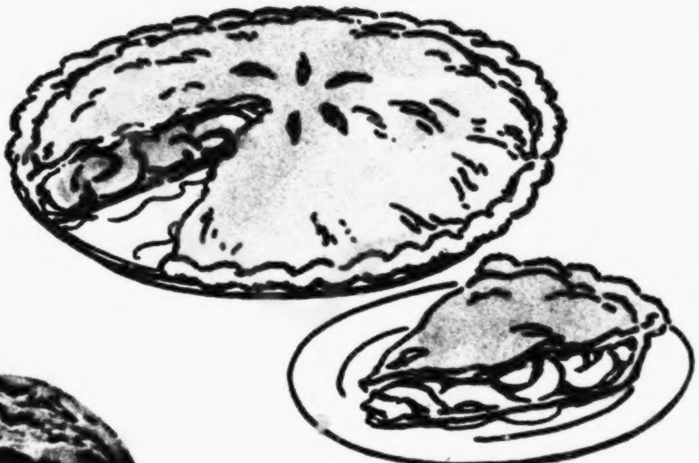

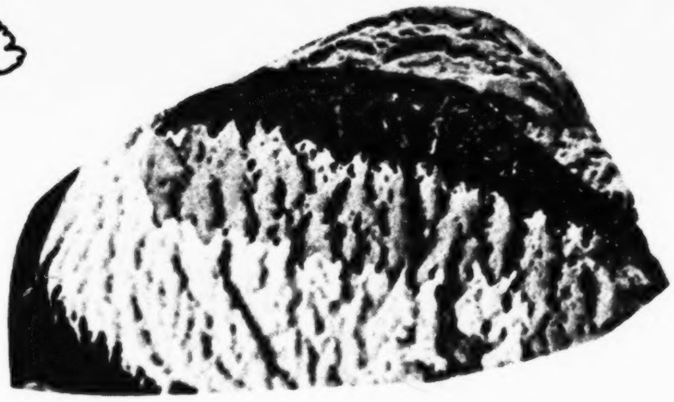

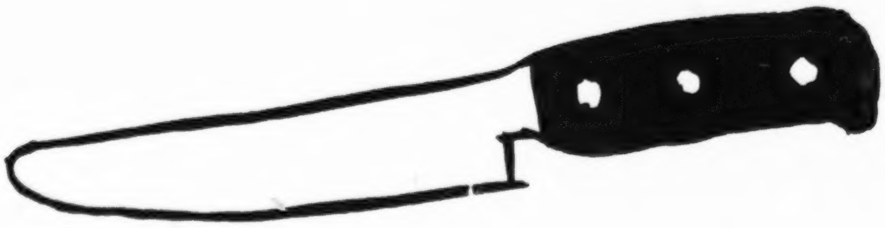

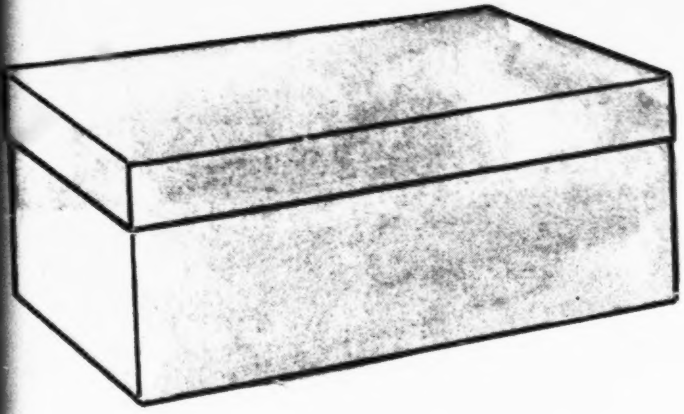

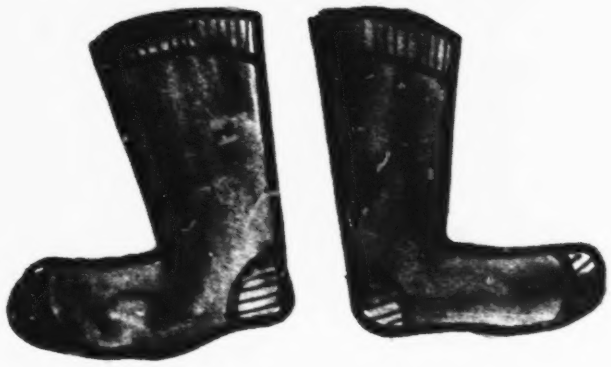

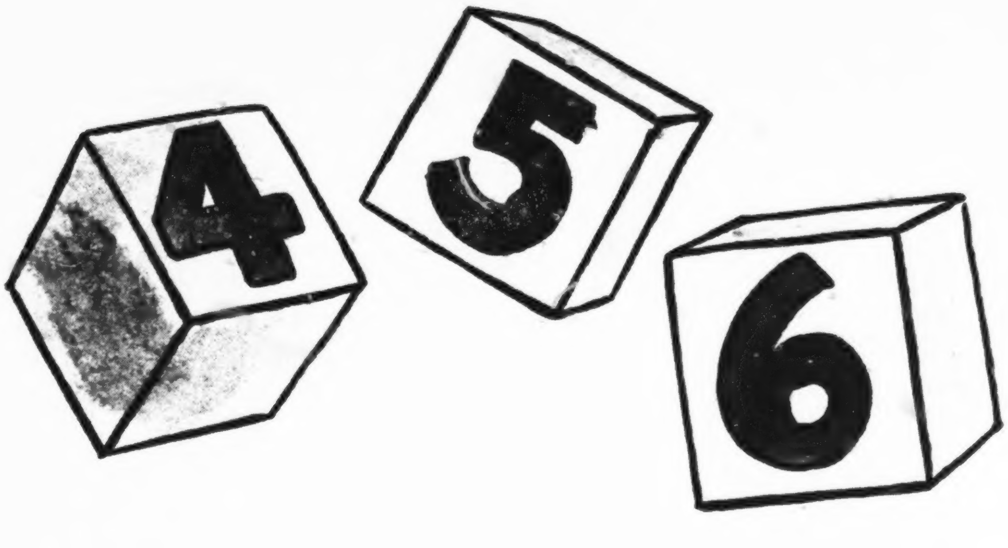
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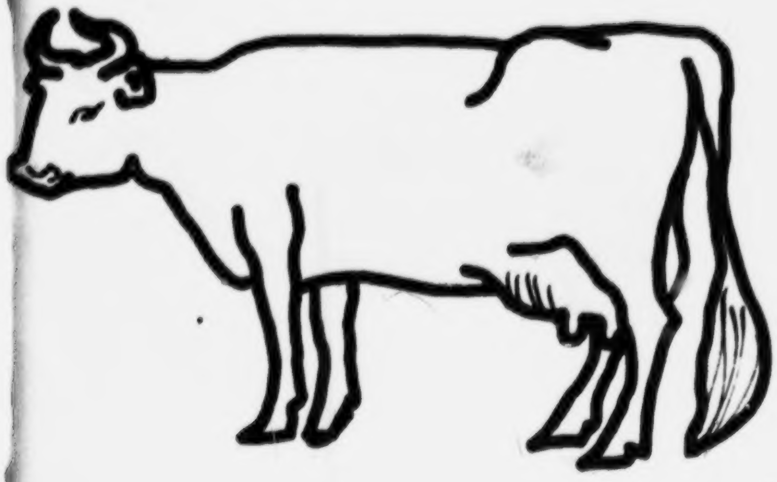

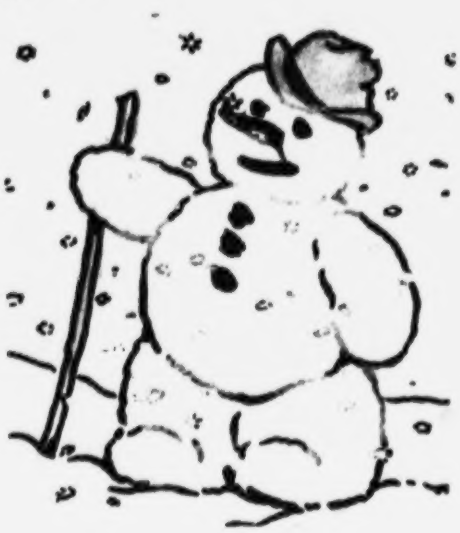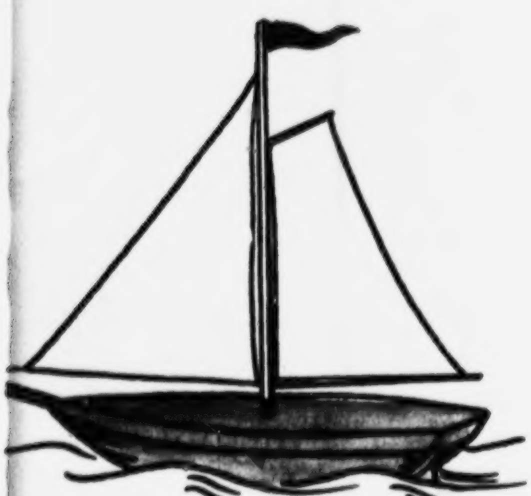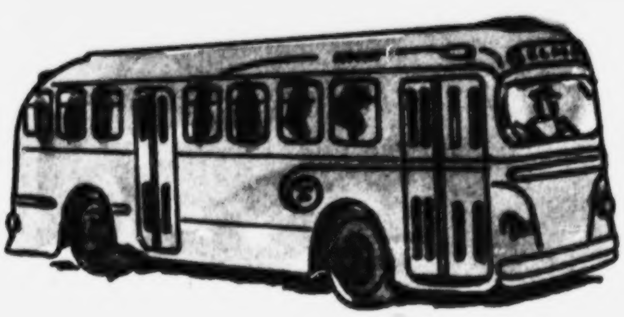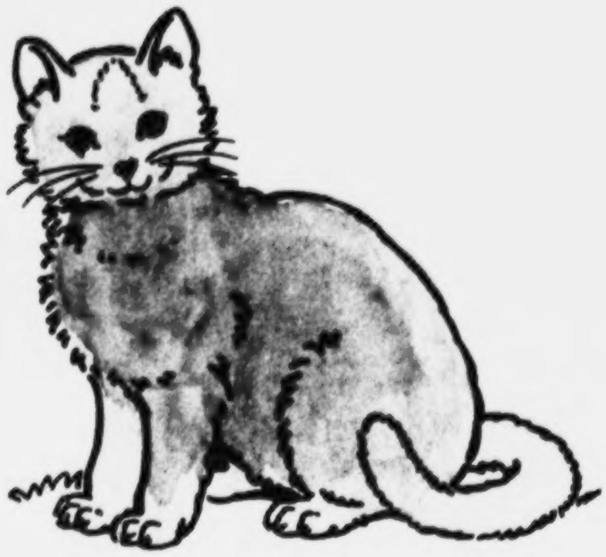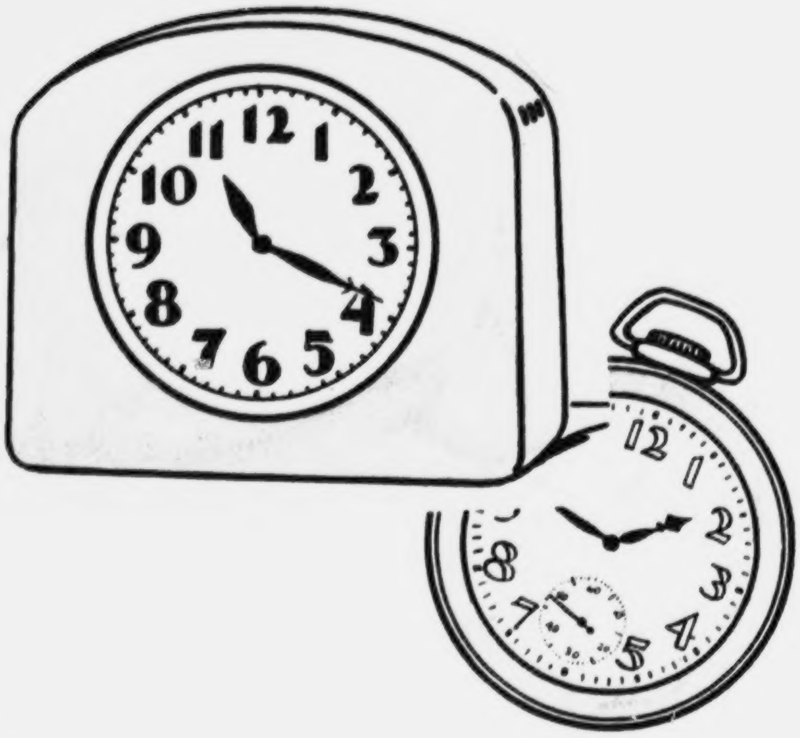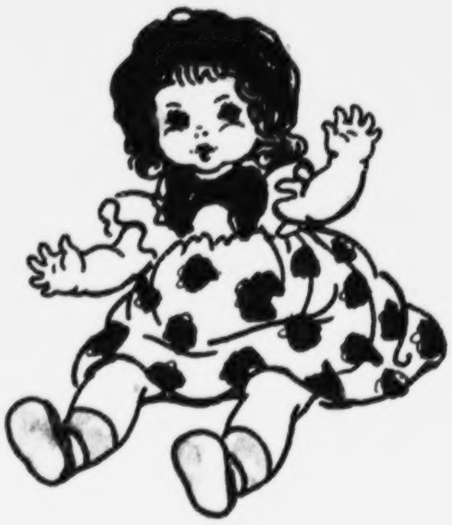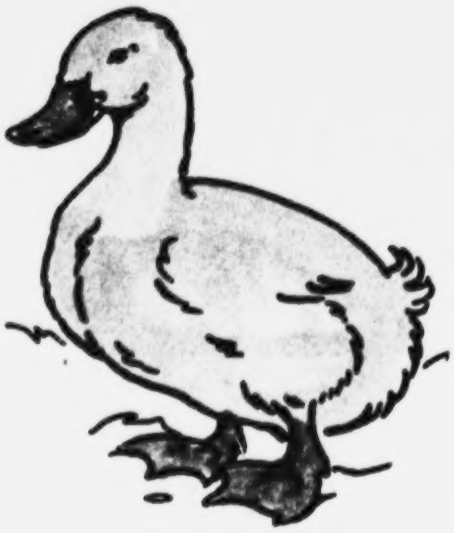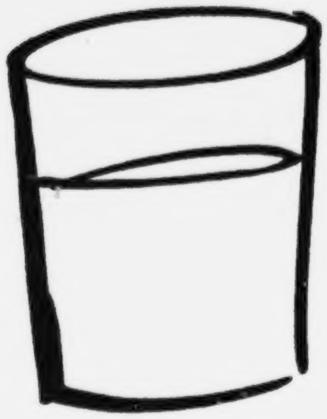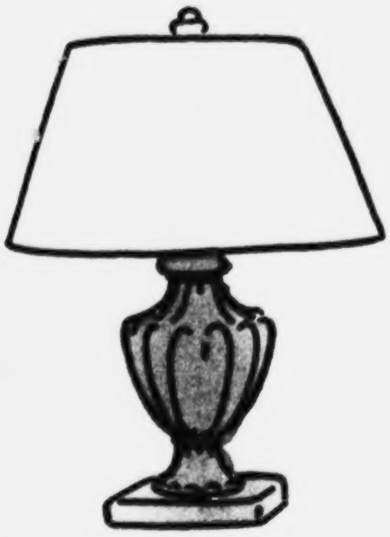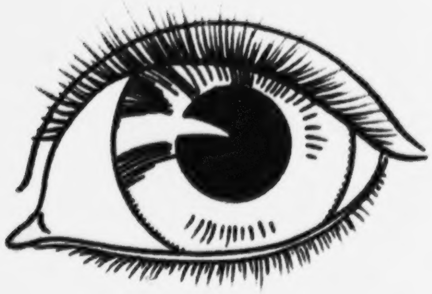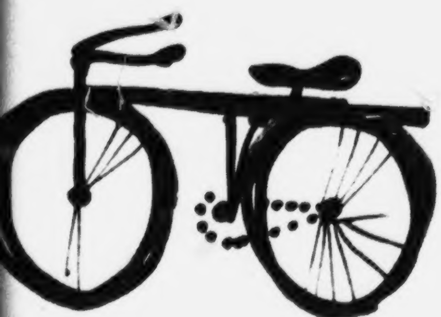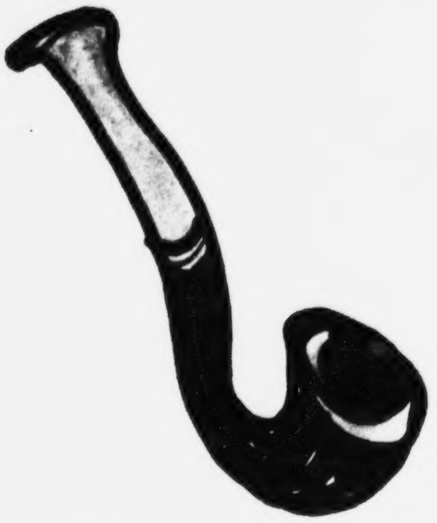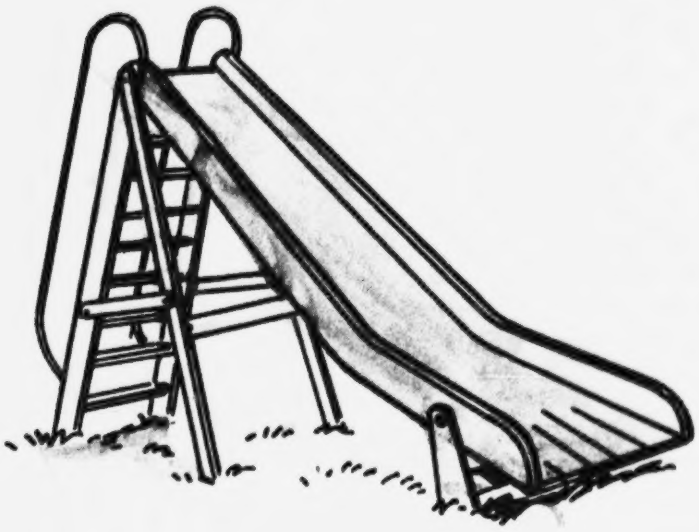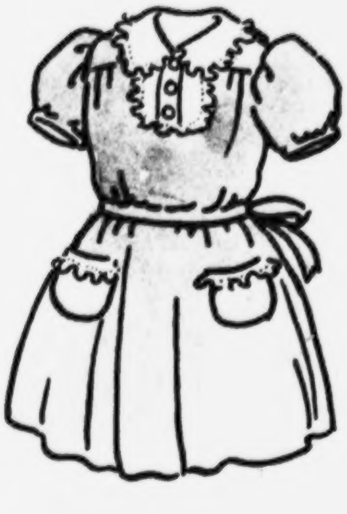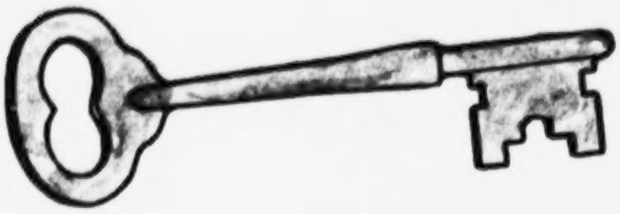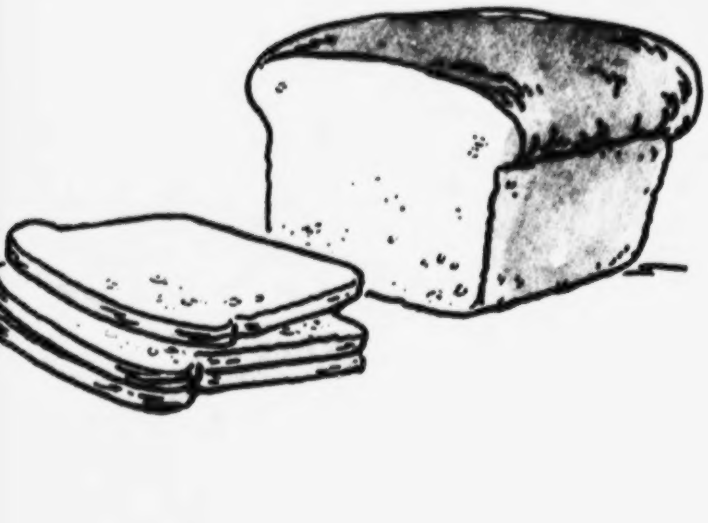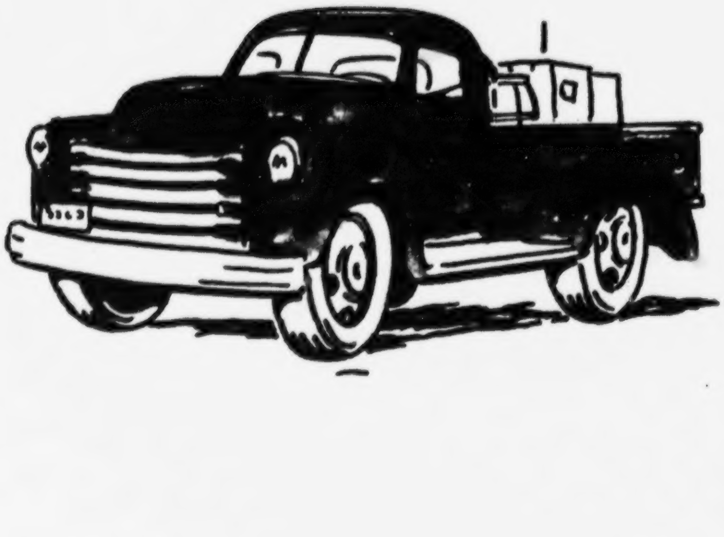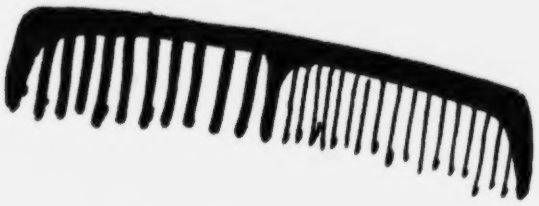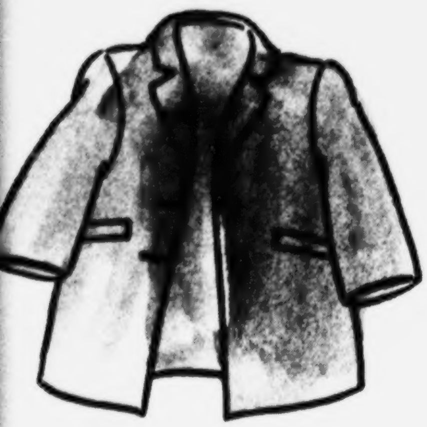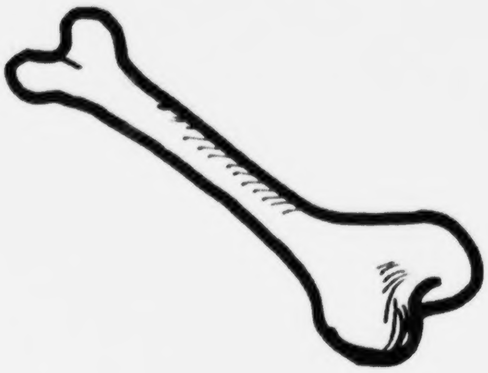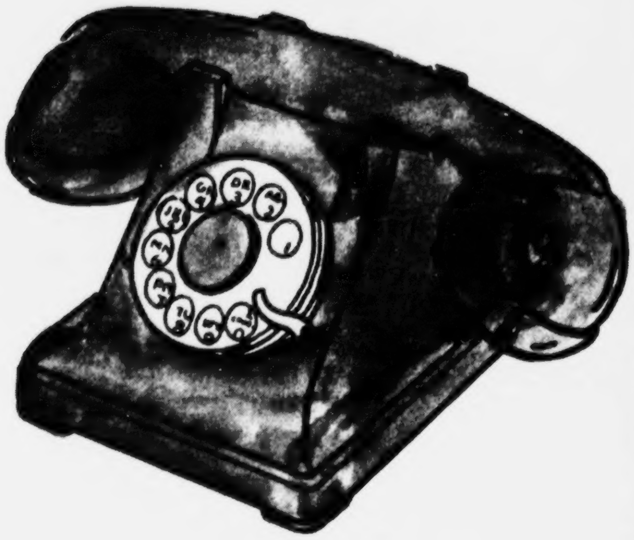ORY